

# METAL FINISHING

DEDICATED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

Founded as Metal Industry, January, 1903  
by Palmer H. Langdon, 1868-1935

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Mutual 7827

Published Monthly by

METAL INDUSTRY PUBLISHING CO., INC.

11 West 42nd St.

New York 18, N. Y.

Telephone: PEnnsylvania 6-0226

also publishers of

Organic Finishing, monthly, \$1.00 per year

Guidebook-Directory for the Metal Finishing

Industries, annually, \$1.50



Copyright 1947 by The Metal Industry Publishing Company, Incorporated. Entered February 25, 1903, at New York, N. Y., as second class matter under Act of Congress, March 3, 1879. Re-entered as second class matter June 13, 1940, at the post office at New York, N. Y., under the Act of March 3, 1879.

SUBSCRIPTION PRICES: United States, \$3.00 and Canada, \$3.00 per year. Other countries \$7.50. Single copies 35c in U. S. and Canada, Foreign 75c. Please remit by check or money order; cash should be registered.

Contributed articles, communications, etc., on pertinent subjects are invited. Their publication, however, does not necessarily imply editorial endorsement.

SEPTEMBER, 1947

VOL. 45 • NUMBER 9

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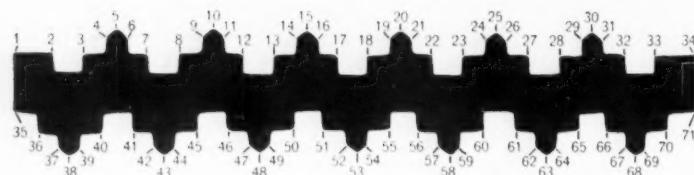
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VOLUME 45 • NUMBER 9 • SEPTEMBER 1947

# METAL FINISHING

## Nickel Coatings

Thickness of nickel, particularly under chromium in the decorative cycle, is as varied as the products being plated. In a great many instances, no thickness is set at all, thickness and quality of plate depending upon the judgment and ability of the plater.

Because of the importance of nickel in this cycle, both the manufacturer and purchaser should set a specification upon the product. Nickel gives not only the necessary corrosion resistance but also gives wear resistance in addition to other advantages, such as luster retention under chromium, spot-out prevention in die-cast basis metals, etc. However, if the nickel coating will not stand up in the application for which it is designed, it is senseless to apply it; hence a standard or specification for a given product should be selected and periodic testing performed by both the manufacturer and the purchaser to insure accuracy.

Most standards for the decorative cycle are based on current A.S.T.M. specifications. Those who do not now use these specifications would do well to obtain copies and study them over. Coatings consisting of copper, nickel and chromium, or nickel and chromium on steel, copper and copper-base alloys, zinc and zinc-base alloys are fully covered. In looking these specifications over, it will be found that the nickel coating is the most critical one, and rightly so because it is the key to the life of the product.

A good example of specification plating is that of re-plating bumpers for pleasure vehicles, which is based upon the plating specifications of motor-car manufacturers for new bumpers and all supplementary bumper parts. In general, 0.0015" of nickel is specified where no copper is used underneath; where the combination is used, the nickel coating must be at least half the thickness of the two. All chromium coatings are in the order of 0.00001".

With nickel in all its forms becoming more and more available, there is no reason why heavier coatings of this metal cannot be used, especially inasmuch as relatively high-speed nickel baths are available and the additional cost, once the parts are in the tank, is negligible.

The plating industry is judged by the man in the street on the basis of how soon the product corrodes and how well it retains its luster. In this respect, then, the industry can be saved many a black eye by adding just a little more thickness of nickel, or better still, plating nickel to specifications.

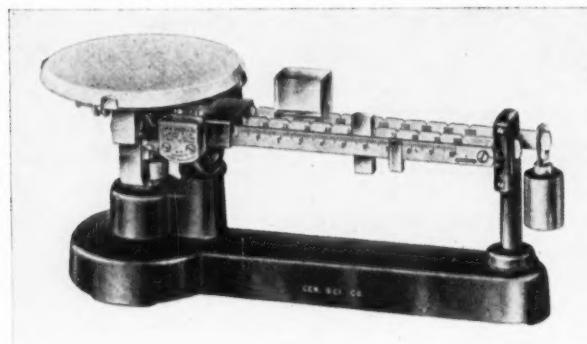
# Electroplating Control Laboratory

By H. J. Sedusky and J. B. Mohler, Research Chemists, The Cleveland Graphite Bronze Company

**A** PLATING bath will not operate for long periods of time without control. Economically, this statement is true.

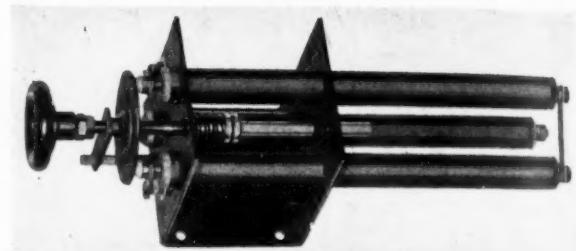
Actually, some baths may be operated until the metal is almost depleted and the bath then discarded. Take an alkaline tin bath for example. Such a bath can be made simply from sodium stannate and caustic soda and operated without control. Steel anodes can be used and the bath worked until the tin is practically depleted. During the operation of this type of bath, caustic is used up to form carbonate; but with the use of insoluble anodes caustic will form from the sodium stannate as tin is removed. Of course, the plating rate will progressively decrease along with the decrease in tin content. The question is: Would it be better to measure the plating rate and dump the bath when it becomes depleted, or control the tin and caustic contents?

It is possible to operate the alkaline tin bath merely by adding sodium stannate and using steel anodes. If such a bath is used only occasionally it is more practical to do this than to bother with the control problem presented by the use of tin anodes. In one case, a small bath was operated in this fashion for several years. Caustic control was ignored, and eventually an equilibrium was reached, where the caustic converted to carbonate was equal to the caustic formed. Sodium stannate was added daily based on the hours of electrolysis. An analysis and adjustment for tin content was made weekly.



Courtesy Central Scientific Company

Figure 1. Triple beam balance, capacity 2 kilograms, sensitivity one-tenth gram.



Courtesy Allen-Bradley Company

Figure 2. Triple carbon pile rheostat, capacity of 200 amperes for low voltage.

If an alkaline tin bath is to be run on an automatic machine, caustic will form too rapidly if insoluble anodes are used. Anode control is not difficult with continuous plating, (and replenishment with tin from tin anodes is much cheaper than tin from sodium stannate). It is therefore economical to control such a bath.

A pickle or a cleaner are often made up, run for several days to a week and then dumped. If questionable impurities are liable to accumulate in this period of time, it often pays to dump rather than analyze. This procedure is often used on a small scale.

In small scale plating operations, solution control must be rapid and inexpensive. The control laboratory may consist of a few bottles of chemicals and a few pieces of glassware, or simple test equipment kept in a corner of the shop.

When plating is on a large scale it pays to have a completely equipped and well staffed laboratory. This laboratory should provide simple control equipment at the plating line, be prepared for complete analyses of baths; be ready to test quality of the plate and be able to solve new plating troubles.

Whether the control laboratory be large or small, it is convenient to run simple analyses in the vicinity of the plating units. An analysis such as for free cyanide may be run at the plating line with less effort than taking samples for the laboratory and transmitting results. If an appreciable number of these simple tests are to be run, a small control laboratory may be set up in addition to a larger laboratory (for complete analysis and testing).

Most of the plating baths can be analyzed with a

small amount of equipment. Much can be done without an analytical balance and without a hood. If a hood is not available, cyanide baths cannot be analyzed where displacement of the cyanide with acid is required. This can be overcome in several ways:

1. Removal of the metal as an insoluble compound. Such as the precipitation of silver with sodium sulfide.
2. Removal of the metal by displacement with a more active metal. Such as the removal of copper by the use of powdered zinc.
3. Removal of the cyanides. Such as reducing the solubility of sodium cyanide by addition of alcohol.

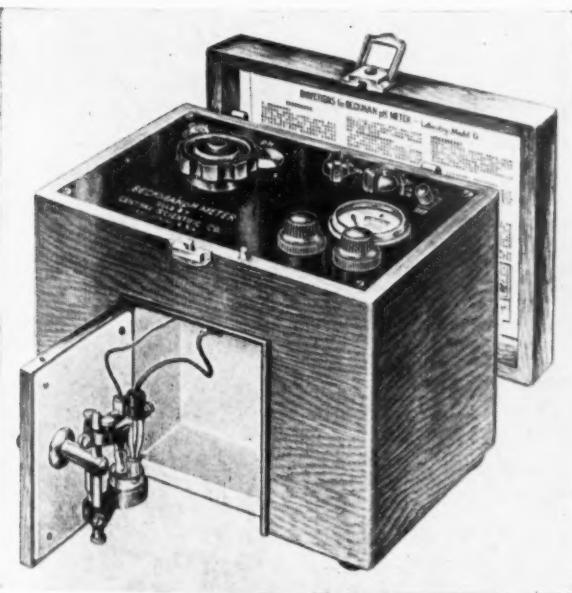
### Equipment

How accurate does control have to be? This question should be kept in mind during the selection of equipment.

The most expensive apparatus is not always the best. A fine watch will corrode just as fast as a cheap one if both are exposed to chemicals. The damage to a good instrument may cost more for repair than the cost of a new, cheaper, more rugged one.

The accuracy required for analytical equipment depends on the precision of the analytical method. Precise analytical procedures are conducted with a reproducibility of 0.2 percent. The equipment should be more accurate than this, (in the order of 0.1 percent). For errors of this order the absolute over-all error of the method may be of the order of 0.5 percent. Accuracy of this order, or better, will be required if analyses for silver in silver cyanide salt are to be made where the purpose of the analysis is to determine whether the salt contains the minimum guaranteed silver content.

A silver bath is a different story. Here it is only necessary to maintain the silver concentration within reasonable limits. The limits may vary as much as plus or minus 25 percent from the mean. Therefore, an analytical method with a 5 percent error is satisfac-



Courtesy Central Scientific Company  
Figure 3. Laboratory pH meter.

tory. In fact, it is a desirable method since less accuracy means greater speed. Five percent error is a good figure to assume for plating work. For an error of this magnitude it is easy to apply rapid methods and it is allowable to use inexpensive analytical equipment.

### Glassware

Beakers, burettes, pipettes, flasks, stirring rods, funnels and so forth are so common that we need not elaborate on them.

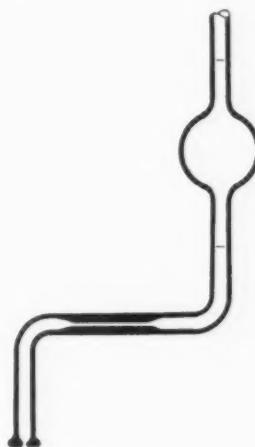


Figure 4. Stalagometer.

Cheap volumetric equipment is entirely satisfactory. This includes pipettes, burettes and volumetric flasks.

Cheap flasks and beakers are not satisfactory unless they are heat resistant.

Filter paper does not have to be high grade. The small impurities in paper ordinarily used for qualitative work will not interfere with a plating analysis. A few boxes of "ashless" paper may be kept for occasional precise work, but these papers are expensive.

Small, simple equipment is a great aid to any laboratory. It is profitable to browse through the chemical supply catalogs regularly to refresh one's memory on the various pieces of equipment that are available.

### Balances

Next in importance to a few pieces of glassware, is a small balance. An inexpensive, rugged instrument of 500 or 1000 gram capacity, weighing to one-tenth of a gram is very useful. Such a balance is of sufficient accuracy to make up standard solutions for plating control. If we assume an over-all analytical error of 5 percent this balance will be well within the required accuracy.

As an example:

To make one liter of tenth normal silver nitrate solution weigh out 17.0 grams of  $\text{AgNO}_3$  and make to one liter with distilled water. Assume the weight to be 17.0 plus or minus 0.1 gram. The error will be 0.1 of a gram in 17 grams or

$$\frac{0.1 \times 100}{17.0} = 0.6\% \text{ error}$$

The error may be positive or negative but it will not exceed 0.6 percent. If desired, it may be cut to 0.3 percent by weighing 34.0 grams and making two liters of solution.

If a considerable amount of analytical work is carried out, an analytical balance will be convenient. The range of work can be widely extended by the addition of this instrument to the laboratory. Gravimetric and electrolytic analysis will be possible. Plating rates may be measured and precise standard solutions can be made up, where they are required. The balance should be of 100 or 200 gram capacity and should have a sensitivity of at least one milligram. An expensive instrument is not necessary but speed in weighing can be obtained by spending a little more money for a balance.

If a balance is purchased that uses a chain and a notched beam in place of fractional weights, weighing can be done rapidly.

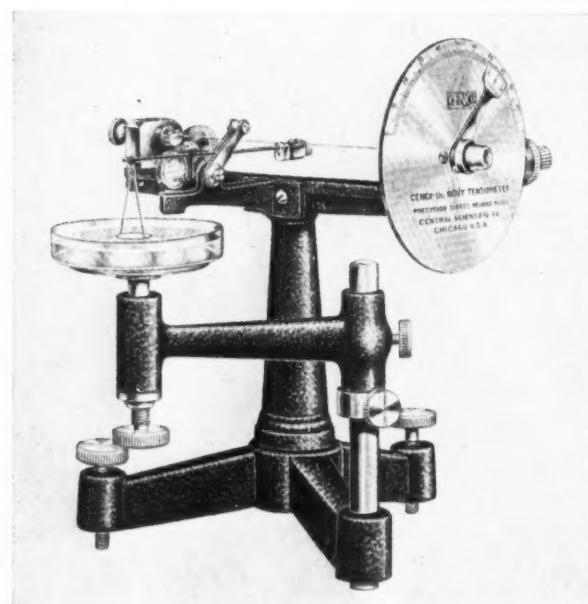
For rapid weighing, the following single-deflection method is recommended:

Adjust the unloaded balance so that on releasing the pan rests the pointer swings 5 divisions to the right. On weighing a sample apply weight until the same condition exists.

Where a considerable number of small experimental baths are prepared, a balance of 2 to 5 kilogram capacity is a necessity. This balance should have a sensitivity of one gram, to accommodate rough weighing. An excellent balance for this purpose is the "computagram" type laboratory scale. Weighing to a definite quantity is made easy by this continuous, direct-reading balance.

### Electrical Equipment

The most pertinent question confronting a person laying out a plating control laboratory is: What sort



Courtesy Central Scientific Company  
Figure 5. duNuoy Tensiometer.

of direct current source shall the laboratory have? The question usually is not primarily concerned with the type of equipment, whether it be a rectifier, a motor-generator set, or batteries. The question is mostly concerned with the voltage.

What voltage should be available?

It is obvious that 6 volts will be sufficient for most work, but what if 12 volts is needed? Higher voltages may be required for experimentation with chromium plating. If 12 volts is available, 20 or 50 may be needed. Voltages of 50 or more may be required for experimental anodizing.

Suppose we install a 60 volt current source and only 3 volts is required. Then we have to provide for a 57 volt drop across the rheostat and leads. Now we need a large rheostat to dissipate heat for such a voltage drop.

Most work will be low voltage work, so a current source of 6 to 9 volts should be available. For occasional high voltage work, a source of less current at 100 volts will be very convenient. An adequate rheostat will be required; or if a rectifier is used a variable transformer can be used on the alternating current side. The capacity is a matter of expected requirements. This should be earnestly considered, since high voltage direct current is an expensive installation. On a basis of 6 volts, it may be assumed that direct current equipment costs one dollar per ampere; 500 amperes—500 dollars. The equipment however is actually on a wattage basis so that 500 dollars may only purchase about 25 amperes of 100 volt current.

Savings are always possible on second hand equipment. The most inexpensive high voltage source can probably be obtained by buying a second hand direct current motor, and driving it with an alternating current motor to make a motor-generator set.

### Rheostats

Laboratory rheostats are a problem in that many resistance ranges are required to cover all operations.

The fixed parallel resistance type of rheostat, known as a tank rheostat is not available in small sizes. It may be used for experimentation with current up to 100 amperes, such as small scale chrome plating.

For work requiring small currents, the wire wound type of rheostat used in physics laboratories is often used. This type is convenient because a fixed position on the rheostat will result in a definite resistance. The disadvantage of this type is that when it is exposed to chemical fumes it requires daily cleaning to assure good contact. There are modifications of the wire wound type available that are constructed to resist the effect of fumes and where wiping contacts keeps the exposed wire clean.

The carbon compression rheostat is inexpensive and reliable. Its main disadvantage is that the resistance changes as it heats and resetting is required (unless current is allowed to flow about 10 minutes before use). It has the advantage of functioning perfectly in the presence of fumes and dirt. The control is stepless since it works on the following principle: It

consists of a pile of carbon plates (carbon pile), and a means of applying pressure. As the pressure is increased the plates make better contact with each other and conduct more current.

Carbon compression rheostats may vary in resistance from a fraction of an ohm up to 100,000 ohms and may be used economically for laboratory work up to 100 amperes. Unfortunately these instruments are only available in a few stock sizes. This requires that calculations be made to supply the manufacturer with information to build the required rheostat. Such a method of ordering is an advantage in that you get a rheostat custom made to fit the job.

The following example will illustrate the calculations for a laboratory rheostat:

The operation of small laboratory baths is usually carried out over a voltage range of from a fraction of a volt to about four volts. A good average figure is two volts. If a seven volt current source is available we have:  $7 - 2 = 5$  volts drop across the rheostat.

A rheostat of 10 ampere capacity is convenient for laboratory jobs.

$$R = E = 5 = .5 \text{ ohm}$$

$$I = 10$$

$$\text{Minimum resistance} = .5 \text{ ohm}$$

The rheostat will cover a range of 40 times, so:  
 $.10 \times .5 = 20 \text{ ohms}$

$$\text{Maximum resistance} = 20 \text{ ohms}$$

$$\text{Approximate wattage} = 4 \times 10 = 40 \text{ watts}$$

Table No. 1 shows data taken on a 60 watt rheostat with a guaranteed range of .5 to 20 ohms.

TABLE NO. 1

Amps	Volts	Ohms	Watts
.1	6.0	60	.6
.5	5.9	11.8	2.9
2.0	5.8	2.9	11.6
5.0	5.4	1.08	27.0
10.0	4.8	0.48	48.0
16.0	4.2	0.26	67.0

It is seen that the range is greater than 40 to 1 and the wattage is a little greater than expected at 10 amperes. Incidentally it should be pointed out that there is no connection between line voltage and the capacity of the rheostat. If 10 amperes are passed through the above rheostat the drop will be 4.2 volts. If excess voltage is applied the rheostat will burn out.

### Meters

Ordinary work in the plating laboratory does not require precision meters. These are like fine watches; a joy to have but not built to stand abuse. A less accurate, but reliable and more rugged meter will take less trips to the repair shop.

For occasional accurate readings, one good 50 millivolt meter should be available. By the use of proper external shunts such a meter may be used as a one ampere ammeter, or in any range up to 1000 amperes. It may be used to check other meters and it may be used to check shunts. If a thermocouple



Courtesy Central Scientific Company

Figure 6. Photoelectric colorimeter.

is available it may be used to check temperatures. If such a meter is ordered, shunts or thermocouple leads should be ordered at the same time to assure the proper resistance in the external circuit.

### pH Meter

If many pH measurements are to be made it is worth while to have a research type, electrometric pH meter. Measurements can be made with papers or dyes and these should be used for rough control, but a meter that is accurate to 0.02 pH unit is a reliable reference. Such a meter may also be used for titrations to a definite pH. These titrations, where the end-point is not sharp enough with indicators, are easily made with this meter.

The electrometric meters are of two types. One employs a continuous reading voltmeter and the other has a potentiometer circuit. The former is rapid reading and accurate for pH to 0.1 unit. The latter is more accurate and still fairly rapid.

### Potentiometer

A potentiometer is often useful in the laboratory. It may be used for:

1. Measurement of electrode potentials.
2. Measurement of polarization.
3. An ammeter in connection with a shunt.
4. Checking electric meters.
5. Measurement of temperatures with a thermocouple.

A potentiometer may be used in the same manner as a 50 millivolt meter. The potentiometer is more accurate and resistance of the leads does not have to be considered since it is a balanced-circuit instrument.

If a potentiometer is required, the purpose for which it is to be used will have to be considered. If it is to be used for thermocouples and to check meters, a 50 or 75 millivolt instrument will be desirable. If it is to be used for electrode potentials a 1 or 2 volt instrument will be necessary.

(To be concluded next month)

# Practical Copper Reduction On Non-Conductors

By Harold Marcus, Pres. and Tech. Dir., Electrochemical Industries, Leominster, Mass.

A new practical method of reducing copper on non-conductors to be used for subsequent metallic coatings has been developed by the author. Actual copper reduction takes place by treatment with Fehling's Solution and a metallo-organic derivative of sodium hydro-sulfite. The commercial adaptability of this process for plating on plastics is explained, together with advantages over the usual silver nitrate method.—Ed.

## Introduction

THE chemical reduction methods presently employed for forming conductive films on plastics, glass or other non-conductive surfaces prior to the subsequent electrodeposition of metals thereon, generally with very few exceptions, utilize a thin film of silver which is obtained by reducing an alkaline silver nitrate solution with either an organic or inorganic reducing agent. These procedures for plating on non-conductors, described in both the patent and trade literature, have been successful in the majority of cases but nevertheless, improvements were much desired. For example, the questionable adhesion of the composite metallic coating to the basis inert material, whether it be a synthetic resinous substance, glass, wood or any non-conductive object, necessitated revision of the methods employed. Furthermore, the relatively high cost of the basic chemical, silver nitrate, used in the formulations, limited their use since the cost of the completed plated plastic part exceeded the cost of the same part as a plated metal by an appreciable amount.

In addition, the ever-present hazards attached to the employment of silver nitrate in an alkaline medium, namely, its susceptibility to explosiveness under these conditions, as pointed out in the Bureau of Standards Circular No. 389<sup>1</sup>, also provided an impetus to seek changes in the processes for plating on non-conductive surfaces.

Although other metallic films such as lead, iron, nickel, etc., have been deposited with some degree of success on non-conductive surfaces<sup>2</sup>, the most reasonable film substitution for the silver film seemed to be the formation of a suitable copper film since it could be obtained from an inexpensive aqueous

solution of a copper salt by chemical reduction and it possessed, under the proper conditions, sufficient conductivity so that instant electrodeposition could take place.

The deposition of copper films by chemical reduction upon non-conductive surfaces, particularly glass is by no means new, but commercially successful methods for forming these films on plastics for subsequent electroplating are not readily available to the industry. This is unfortunate since we are more concerned with the plating of plastics than the other non-conductive surfaces, mainly because plastics are more generally employed as the basis material since these resins have been established upon their own merits.

Therefore, the most logical starting point in any initial investigation involving the formation of copper films was to employ plastics as the basis material and to study the available formulations found in the literature for depositing copper films on materials such as glass, especially their behavior on the wide variety of commercial synthetic resins. Hence, this represented the first step in our investigations which were begun a few years ago. All the formulations which were summarized in the treatise, "Metallizing Non-Conductors," by S. Wein<sup>3</sup>, and which appeared workable for depositing copper films were made up in the laboratory and each was employed for the formation of a suitable copper film on plastics. The following, reviewed in the aforementioned book, represents some of the methods tested. Reference was made to the methods of Herrmann<sup>4</sup>, Bamberger and Schweitzer<sup>5</sup>, Noto and Uno<sup>6</sup>, Weiskopf<sup>7,8</sup>, French<sup>9</sup>, Chattaway<sup>10</sup>, and Abramson<sup>11</sup>. There were additional formulations for depositing copper films (see Mischetti<sup>12</sup>, Peacock<sup>13</sup> and others) but these methods required the use of silver nitrate and therefore had no place in our scheme of investigation.

In all the foregoing methods tested, cellulose acetate was used as the basis material. The pretreatment procedures, such as the degree of roughening of the plastic, its cleaning and so-called "sensitizing" were widely varied. Chemical etches, mechanical rolling and blasting were employed for de-glazing of the plastic part. A variety of proprietary cleaners, wet-

ting agents and varying strengths of caustic soda were used for cleaning the surface. The "sensitizing" treatment was applied using all the formulations known in this specialized field. Varying the length of treatment was also exercised. Likewise the length of time in the coppering mixtures was altered. The number of treatments in the coppering solutions was increased if there was the slightest sign of a possible copper formation. In other words, all the methods tested were studied very closely under varying conditions.

### Summary of Results

In all the formulations investigated the formation of the copper film on the plastic proceeded very slowly with inconsistent results. In all cases, a non-continuous film was evident. Heating the coppering mixtures to a range of temperatures between 30° C and 90° C was necessary to accelerate formation of the copper film if any signs of a possible formation revealed itself. It is obvious that this procedure is objectionable in the case of metallizing thermoplastic materials because of their respective distortion temperatures.

It was observed that there seemed to be an incomplete reduction of the copper salt to metallic copper since the major part of the copper formed in solution and not on the plastic surface. Furthermore, the adhesion of the copper film which did form on the plastic surface was non-adherent and possessed a marked degree of sponginess. Sludge and the formation of tarry products in the solution mixture was very noticeable. In some formulations there was a pungent gas evolution accompanied by irritating vapors. It was readily seen, on the basis of the investigations conducted, that a suitable commercial process for depositing copper films on plastics was still lacking.

### Copper Reduction Process\*

The copper reduction process for which patents have been applied and to be described in the following paragraphs is to the best of the author's knowledge the first commercially successful process to be introduced to the industry for depositing films on plastics for the subsequent electrodeposition of copper or silver as an intermediate coating and with a final top coat of the desired metal. All plastic materials such as the cellulose compounds, phenol and urea formaldehyde resins, vinyls and styrenes are now being successfully metallized employing this process without using chemically reduced silver films for conductivity but, in their stead, *copper films*.

This process for depositing metallic copper films basically involves the following steps:

- (1) roughening or "de-glazing" the plastic surface either chemically or mechanically.
- (2) cleaning the surface
- (3) "sensitizing" the surface
- (4) "activating" the surface
- (5) formation of the copper film by chemical reduction

\* Cupron Process, Electrochemical Industries, Patent Pending.

An intermediate layer of electrodeposited copper or silver is then applied followed by the final or outer deposited metal.

### Roughening or "De-glazing" Operation

This operation, which is carried out in order to roughen the surface slightly or to remove the sheen from the plastic article as it comes from the molding machine, is usually performed by wet-tumbling in a mixture of 100 mesh pumice and water for a few hours, blasting with 220 grain aluminum oxide or etching the part chemically. In the event that the molded part possesses a "flash" or feather edge on its surface, the wet tumbling operation is recommended.

Etching the part chemically must be done with extreme care so that the etchant will not cause too severe an etching action. If acid etches are employed, the excess acid must be immediately rinsed away and the part immersed in a neutralizing solution such as a 10% sodium carbonate solution.

### Cleaning the Surface

The surface of the plastic must be freed from any greasy film, finger marks or contamination following the roughening operation, otherwise a non-continuous, non-adherent copper film may result. Mild proprietary cleaners such as those used for cleaning non-ferrous metals suffice in the majority of cases. Wetting agents may be employed if the surface requires only a slight degree of cleaning or "wetting out." Elevated temperatures must be avoided especially in the case of plastic materials with low distortion temperatures.

### Sensitizing the Surface

After the plastic surface has been "de-glazed" and properly cleaned it is immediately transferred, without drying, into the "sensitizing" solution. This treatment is applied by immersing the plastic part, after rinsing away the cleaner, for one to two minutes in a dilute solution of titanium dioxide in the presence of hydrochloric or sulphuric acid. Since titanium dioxide is insoluble in all acids and in order to bring it into solution, it is best to fuse it with sodium carbonate or potassium pyrosulphate; then treat the melt with hydrochloric acid or sulphuric acid, respectively.

The mechanism of the chemical reaction in the latter case is:



The titanium dioxide is converted to titanium sulphate which is soluble in cold water.

Thorough rinsing follows the treatment of the de-glazed and cleaned plastic part in the above sensitizing solution.

The purpose of this "sensitizing" treatment is to incorporate into the pores of the plastic surface reductive, divalent  $\text{Ti}^{+2}$  ions which indirectly facilitate the subsequent reduction of metallic copper therein. This operation is analogous to the use of stannous chloride or similar compounds commonly employed for the formation of silver films on plastics prior to plating.

### Activating the Surface

The "activating" treatment is carried out by immersing the plastic part, after the "sensitizing" treatment, for five minutes in a very dilute chloroplatinic acid solution ( $H_2PtCl_6$ ). A concentration of 1 gram per gallon of chloroplatinic acid in water is sufficient.

This step in the process is exceedingly important and the success or failure of the method depends upon the proper treatment of the plastic part in this solution. Theorizing, the platinum constituent in the chloroplatinic acid acts as a catalyst accelerating the formation of metallic copper in the subsequent coppering operation or, perhaps the reductive titanium ions already present in the pores of the plastic following the "sensitizing" treatment form an invisible platinum film on the surface of the plastic which aids the formation of the copper film. This invisible film is highly receptive to subsequent coppering.

There is no doubt that a plastic surface is activated by the presence, preferably of a noble metal which takes the form of an invisible film on its surface. Perhaps this activation produces activated centers for the catalytic deposition of the copper from its aqueous solution. This theory was brought out in the work performed by Marhoe and Weyl<sup>14</sup> who stated that although the mechanism of this catalytic reaction is not absolutely certain, it can be explained in the following ways:

- (1) the copper ions are adsorbed by the atomic platinum molecules;
- (2) an electron is transferred to the copper which leads to metallic copper;
- (3) a molecule of reducing agent (employed in the reduction process) is adsorbed by the copper first formed;
- (4) the reducing agent employed in the process transfers an electron to the metallic copper.

### Formation of the Copper Film

The copper film is produced by reduction of Fehling's Solution, using a specially prepared metallo-organic derivative of sodium hydrosulfite. This compound, which is soluble in water, possesses excellent reductive properties, or in other words is a compound of high reduction potential and its metal radical, present in its chemical structure, insures complete reduction of the copper sulphate in the Fehling's Solution to metallic copper. It seems that in all the methods referred to previously in this paper for depositing copper films there is an incomplete reduction of the coppering solution and an excess of copper oxide is present in the mixture. This means a poor copper film formation and may be the reason for the inconsistent results obtained using the methods available in the literature.

Equal volumes of the Fehling's Solution and the specially prepared copper reduction solution are employed for proper reduction of the mixture to metallic copper. The amounts of each used depends upon the square inch area to be coated.

This copper "bonding" or film formation is carried out in inclined or horizontal glass containers rotating at 5 to 6 R.P.M. The pieces to be "bonded" are placed

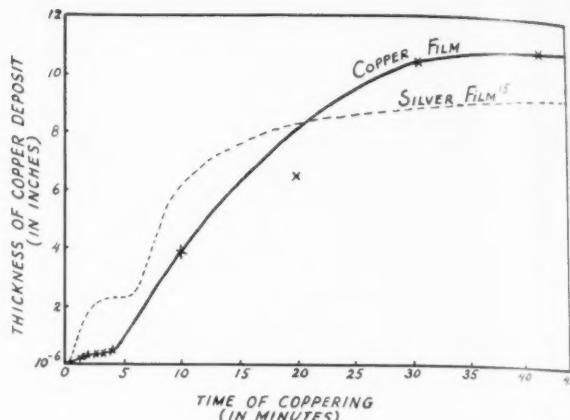


Figure 1. Time of coppering vs. thickness of copper deposit.

in the glass container following the preparatory treatments and covered with water. The required volume of the Fehling's Solution is added and then an equal volume of the copper reducing solution. There is no formation of copper on the plastic surface until after a period of 4 to 5 minutes after which the copper film forms rather rapidly. Bonding continues for 30 to 45 minutes. A second or even third copper film may be applied by discarding the spent coppering mixture and using fresh solutions. Proper conductivity is determined by employment of the usual tests with an ohmmeter or flashlight battery connected in series with a flashlight bulb and test prods.

### Comparison Between the Thickness of Copper and Silver Films

A study was made of the copper film formation on plastics using the direct or "weight" method<sup>15</sup> so that a comparison could be made with the thickness of silver films produced in the same interval of time. In our experiments with the "weight" method for the thickness of the copper film at various time intervals, test specimens of methyl methacrylate resin measuring  $6.0 \times 4.0 \times 0.32$  cm. were employed. The weight of each test panel approximated 9 grams. Each panel was properly cleaned, weighed on an analytical balance to an accuracy of 0.0001 grams and carefully fitted with a rubber stencil or mask so that the copper film would form only on one  $6.0 \times 4.0$  square cm. face. Preparation of the test panel for receiving the copper film consisted of: (1) thoroughly cleaning the surface in a mild proprietary cleaner, (2) "sensitizing" the surface as previously described, (3) "activating" the surface; then each panel was separately coppered in the Fehling's Solution—copper reducing solution mixture for varying lengths of time. After formation of the copper film, each panel was thoroughly rinsed with distilled water, the rubber mask removed, the panel thoroughly dried and again weighed accurately. Using the formula:

$$T = \frac{W}{8.9 \times A}$$

T = Thickness of copper film in cms.

W = Weight of copper film in grams.

A = Area of copper film in square cms.

and taking the density of copper as 8.9 grams per c.c., the thickness of the film at the various time intervals was calculated.

The results obtained for the twelve methyl methacrylate panels tested are shown in the following table:

TABLE I

Thickness of Copper Films Deposited on Methyl Methacrylate Panels using the Direct or "Weight" Method.

Test Panel	Time of Coppering min.	Wgt. of Copper Deposit gr.	Area of Copper Deposit cm. <sup>2</sup>	Thickness of Copper Deposit in.*
1	0.5	0.0000	24.0	0.0000000
2	1.0	0.0000	24.0	0.0000000
3	1.5	0.0001	24.0	0.0000002
4	2.0	0.0001	24.0	0.0000002
5	2.5	0.0001	24.0	0.0000002
6	3.0	0.0001	24.0	0.0000002
7	4.0	0.0003	24.0	0.0000006
8	5.0	0.0005	24.0	0.0000010
9	10.0	0.0022	24.0	0.0000039
10	20.0	0.0034	24.0	0.0000063
11	30.0	0.0058	24.0	0.0000107
12	40.0	0.0061	24.0	0.0000112

(\* 0.0001 = 2.5 microns)

### Interpretation of Results

The results obtained show that during the first three minutes of coppering little or no copper is formed on the properly treated plastic surface. There is a slight increase in thickness of copper during the next minute. From five to ten minutes after the coppering operation was begun, the formation of the copper film becomes more rapid. This rapid rate of copper film formation continues in an even greater degree until after a time interval of 40 minutes the formation of the copper film practically ceases.

This phenomenon is clearly shown in Figure 1 which is a curve resulting from the plotting of time of coppering vs. the thickness of the copper film:

It will be noted that after a period of twenty minutes the thickness of the copper film is greater and continues to be greater than that of the silver film.

### Adhesion of Copper Films to Plastics as Compared to Silver Films

Upon examination of a plastic part which was completely plated using an initial conductive copper film, it was noted that the adhesion of the composite metallic coating was much greater than when a silver film was employed for making the plastic conductive. The adhesion test simply consisted of plating two panels made of cellulose acetate with 0.0005" of copper (in an acid copper bath) and employing a copper film on one and a silver film on the other for conductivity. A section of the composite metal coating was sheared away to expose the basic cellulose acetate material and the metal layer remaining on the panel was pried upwards with a sharp knife. The difference in adhesion was noted. While the test employed was not

quantitative, the adhesion of the metal coating was noticeably greater in the case of the panel coated initially with a copper film. In this case it was difficult to remove the electrodeposited copper as a continuous sheet.

This improved adhesion in the case of the panel plated upon a copper film as compared to the one using a silver film is due to either a metallurgical or chemical effect. The atomic crystal structure of metallic copper as compared with that of silver may be the basis for better adhesion in the case of the former; or perhaps the chemical nature of the preparatory solutions in the copper film formation exercise a more pronounced penetration of the plastic surface than when a surface is prepared for silver.

It is entirely possible that the molecular forces attributing to adhesion in the case of metallic film formation on plastics may be stronger in a copper film than in a silver film; strong enough to counteract the strains and stresses induced in it by the electrodeposition of the metal which follows.

In the copper reduction process for the formation of the copper film on plastics, there is a complete elimination of sludge, heat or gas formation during the reduction of the Fehling's Solution to metallic copper. There is no doubt that a metallic film deposited under these most favorable conditions will be more adherent and continuous possessing a marked degree of strength within itself. Furthermore, the copper film is formed under conditions where the specially prepared reducer, which is capillary active, does not react with the Fehling's Solution with too great a speed forming undesirable reaction products but restricts its activities to those copper ions which are in first contact with the plastic surface previously treated in the "activating" solution. Once the first film of copper atoms has formed, the metal assumes the potential of the reducing agent and from then on the reducing action proceeds at the copper surface.

### Summary

The formulations for depositing copper films on glass or similar hard materials are not applicable to synthetic resins, especially on a commercial basis, even when the pretreatment procedures and operating conditions are altered, for the reasons previously set forth. The copper reduction process on the other hand, is commercially adaptable for plating on plastics and is being used successfully for this purpose.

This process for depositing copper films, not only on glass and like substances, but also on synthetic resins of all chemical structures, consists of roughening or "de-glazing" the plastic surface either mechanically or chemically, cleaning it prior to "sensitizing" in a dilute solution of titanium dioxide in a hydrochloric or sulphuric acid medium, "activating" in a very dilute chloroplatinic acid solution and then forming a continuous, adherent, conductive copper film on this surface by reducing Fehling's Solution with a metallo-organic derivative of sodium hydrosulfite.

An intermediate layer of electrodeposited copper or

(Concluded on page 70)

# Fishtails—An Old Buffing Problem

By T. R. Treadwell, *Divine Brothers Company, Utica, N. Y.*

**The little understood phenomenon of fishtails are herein described. Fishtails occur only in buffing operations on non-ferrous metals mostly because of laxity in polishing operations. The author defines fishtails, gives causes for this buffing fault and outlines a series of corrective measures.—Ed.**

ONE of the most annoying occurrences in the buffing room is an outbreak of fishtails on the surface of a piece of work that is being brought up to a high lustre. All polishing and buffing room foremen have run up against such a condition at one time or another, but not all have been entirely successful in getting rid of them. Just what should be done about fishtails is a question often asked by people in the metal finishing business, and while no hard and fast rules can be laid down for eliminating them, there are a few things that can be tried that will help overcome this old buffing problem.

## Definition

Some people refer to fishtails as drag marks, but old-time polishers maintain there is a distinct difference between the two. A drag mark properly refers to a comet-shaped streak anywhere from a hundredth of an inch to a half inch in length, which appears on the surface of a piece of work after buffing. (Figure 1) A fishtail is really the same as a drag mark only somewhat fancier, in that instead of having just one tail the comet-shaped streak has two, forming a little V-shaped etching on the surface of the work. (Figure 2) It is this V-shape that gives rise to the name fis-

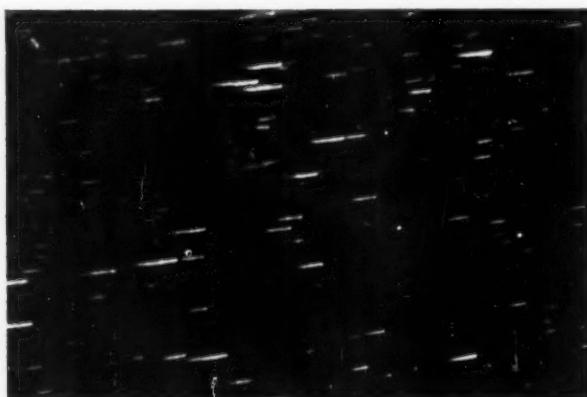


Figure 1. The familiar dragmark. Caused by buffing over pits in the metal. Magnification—6 times;  $\frac{1}{4}$ " gauge sheet aluminum.

tail, although there is no need to be too technical about nomenclature, since drag-marks and fishtails are both caused by the same conditions. The fishtail originates as a drag mark, with one tail caused by a single swipe across the face of the buffing wheel. It remains a drag mark with one tail so long as successive passes on the buff are made in the same direction. But as soon as the work is cross-buffed at a different angle, causing the lines of abrasion to lie in two directions instead of one, another streak is formed. As this second streak originates from the same pit as the first, and the first one is completely wiped out, the familiar V-shaped pattern becomes visible.

Examination of a typical fishtail under a high-

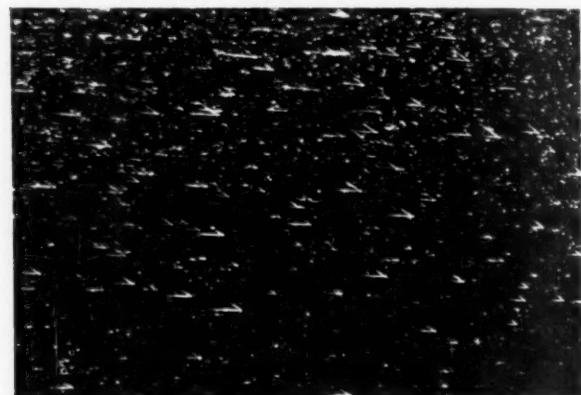


Figure 2. The fishtail. Same as dragmark shown in Figure 1, only cross buffed, giving the "comet" two tails instead of one. Magnification—6 times;  $\frac{1}{4}$ " gauge sheet aluminum.

powered glass reveals that the head of the "comet" is a pit or depression in the surface of the metal, packed full of buffing compound. The tail, or tails of the comet are partly smeared composition and partly tapered grooves in the metal following the trailing edge of the pit. These originated with the action of the buff as it tore across the pit. The diameter of the pit is pinpoint to pinhead in size, and the length of the tail is determined accordingly.

## Causes

Fishtails never appear during polishing. They can break out like a bad case of hives, though, during buffing. The pits which cause fishtails are there during polishing, but the scratches incurred in the pre-buffing operations distort the appearance of the surface enough to make it look as though it is ready to be

buffed, when actually it isn't. This is because some pits still remain on the surface. (Figure 3) Upon buffing, the previous polishing scratches are removed, but this exposes the fatal pits which are deeper than the scratches and which never were eliminated. These pits will lead to fishtails every time, unless proper precautions are taken.

Fishtails seldom occur when working with ferrous metals. They generally appear in the softer metals and are most frequently discovered when working with aluminum or brass. One reason lies in the fact that with the harder metals greater time is given to thorough polishing and pre-buffing operations, simply because it is very difficult to buff a hard metal whose surface has not been properly prepared for it. The thoroughness of these operations almost automatically removes all pits that could lead to fishtailing. Moreover, ferrous metals will not drag out as easily as the softer metals. The sharp edges of any pits, which still might be left exposed to buffing operations, remain relatively sharp instead of being laid down and dragged out in the familiar fishtail pattern.

With the softer metals, however, it has often been found that a comparatively poor surface can be subjected to hard, heavy buffing, with better than acceptable results which, while not of highest quality in many cases, are good enough for what is required. Much

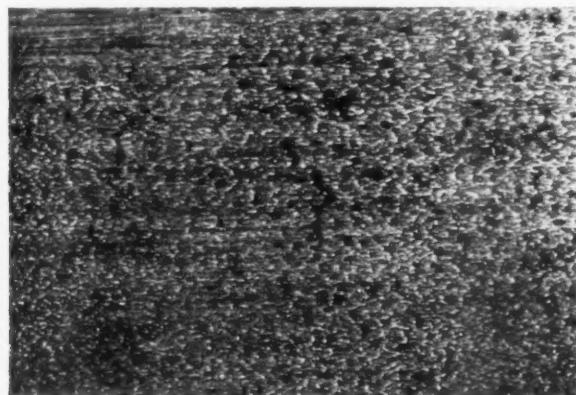


Figure 3. Surface polished with #240 abrasive belt. Polishing has not removed all pits. Fishtails will occur if buffed. Magnification—6 times;  $\frac{1}{4}$ " gauge sheet aluminum.

polishing is eliminated, then, with emphasis placed on the use of hard, fast-cutting, cool-running buffs, under heavy pressures, headed with compounds that can cut and color in one operation. The tendency to sidetrack polishing operations continues, with still harder and heavier buffing taking place, until one day a plague of fishtails descends on the shop, and the finish no longer comes up to inspection standards.

Often in such cases buffers have attempted to buff out the fishtails, but time and again they have failed. By "buffing out" is meant to increase the already substantial pressure and time of dwell during the buffing operation and to use an even harder, faster-cutting buff. The misguided theory is that the metal surrounding the pit can be removed by heavy abrasive action, thus reducing it to the level of the pit bottom, at the same time smoothing and blending the edges, to give a good finished surface free of fishtails. But to the buffer's consternation he more often than not

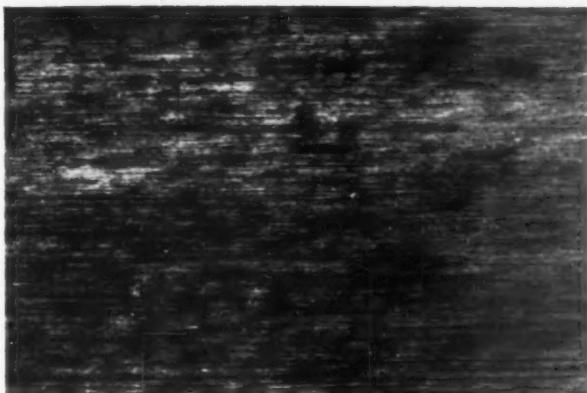


Figure 4. Same surface as in Figure 3, after thorough polishing with #240 belt, then with #320 greased belt. Practically all pits removed, piece is ready for buffing, with no danger of fishtails. Magnification—6 times;  $\frac{1}{4}$ " gauge sheet aluminum.

finds the fishtails getting worse instead of better, using this method. Only now the tails are longer and more pronounced, and, if he took the time to count them, he would probably find more there than he had originally.

What has happened is that the increased pressure and faster cutting action have dragged the metal instead of smoothing and blending it. The edges of the pits have been torn away even further. Metal has been pushed against metal, something like a snowplow pushes snow, leaving grooves worse than before. At the same time more pits are likely to be exposed by this action, giving a greater number of fishtails than previously.

#### Corrective Measures

Fishtails are rapidly becoming more than just a source of petty annoyance for the metal finisher. Today, more than ever since the war, demand for high quality finishes is increasing. "Any old thing" won't do, now that volume flow of production has allowed the buyer to be more selective. Fishtails detract considerably from the appearance of finished goods, whether or not the goods are plated. If plated, fishtails make the cleaning operation more difficult; to say nothing of the unsightly marks that show up under the plating. Getting rid of fishtails is the biggest headache of all, for it often means changes in the polishing and buffing operations, either in character or in sequence.

Under the conditions described previously, when fishtails appear to grow progressively worse under prolonged buffing, it is usually necessary to obtain a better finish, prior to buffing. Examine the piece carefully, therefore, after the last polishing operation, using a high powered magnifying glass. Polishing may have left the surface with many very fine scratches that can easily be buffed out, but if little pits are detected among the scratches, then fishtailing will be almost a certainty. It is these pits that must be removed, either by prolonging the last polishing operation, or by adding another operation somewhere in the sequence prior to buffing. (Figure 4).

Sometimes no pits are discernible among the polishing scratches, but fishtails still appear during buf-

ring. One cause for this can be that the last polishing operation was not fine enough, and although most of the scratches can be removed by buffing, some parts of individual scratches deeper than others will remain, taking the form of elongated pits and eventually resulting in fishtails. When this happens, a finer grit size should be tried on the last pre-buffing operation.

Then there are many cases where no pre-buffing operations exist; such as in some aluminum cooking utensil finishing plants. The finishes obtained in this manner are generally inferior, but marketable. The fishtails necessarily crop out quite often in these cases due to the poor condition of the metal after fabrication, and the only way to prevent them is to polish prior to buffing—an operation frequently very costly.

A common source of trouble is in the buff itself. It has been observed that "horsing" the work on the wheel, and trying to buff out the fishtails only seems to aggravate the condition. Much can be gained, therefore, by substituting a softer buff for the one being used. If no such buff is immediately available, it is possible to put spacers between sections of the original buff to give it a softer face, with less of a tearing action. Softening the face, either with a buff of different construction or one made of different material, and applying less pressure has been a good remedy for many fishtail cases. Certain types of folded buffs can be placed on the spindle in a reverse, or coloring, position, which will tend to soften the face.

With the softer buff, it has been found that a change

of composition will also help. In several instances, when working with aluminum, a silica composition will perform better than tripoli, perhaps because of its slightly sharper cut.

There are a few cases where all attempts to get rid of fishtails have failed. When this happens, the fault usually lies in the poor quality of the metal itself. Some batches may be definitely inferior, being full of mushy spots, air holes, pits and pockets; all of which are detrimental to mechanical finishing operations. Under these conditions it is practically impossible to get a satisfactory finish; one that is devoid of fishtails and other imperfections that cause rejects. The condition of the metal cannot be blamed, however, until everything else in the book has been tried first.

### Summary

Briefly summarizing the suggested methods for preventing the appearance of fishtails on the surface of a piece of work:

1. Don't "horse" the work. Instead, lighten up the pressure against the buff.
2. Try a softer, coloring buff.
3. In some cases, use a faster-cutting composition.
4. Examine the surface prior to buffing. If numerous pits are present, change the polishing set-up to remove them before buffing.
5. Determine whether the metal itself is at fault.

## PRACTICAL COPPER REDUCTION ON NON-CONDUCTORS

(Concluded from page 67)

silver is then applied to the copper film and the top coating of the desired metal.

### Advantages of the Copper Reduction Process as Compared to the Silvering Processes

- (1) The basic chemical from which the copper metal is precipitated by reduction is copper sulphate which sells for approximately one-hundred times less per pound than silver nitrate employed in the silvering processes.
- (2) The adhesion of the composite metal coating to the plastic is greater using a copper film than when using a silver film because the adhesion of the film itself to the plastic is greater under the proper conditions.
- (3) The thickness of the copper film is likewise greater than the silver film after reduction is completed.
- (4) Coppering solutions are not explosive; silvering solutions are, under certain conditions, if proper precautions are not taken.
- (5) Sludge formation and the formation of other undesirable reaction products, during the reduction process, is not evident in the case of copper-

ing employing the copper process while there is a marked tendency towards such formations in silvering, under certain conditions, which results in rough electrodeposits subsequently.

- (6) The ultimate cost of the final plated plastic part is much less using the copper film for making the plastic part a conductor than when a silver film is used. This allows plated plastic items to compete in price with the same part in metal.

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Figure 1. Loading and unloading end of bright nickel plating machine, plating brass antenna tubes.



# High Production Job Shop Plating

By Louis J. Donroe, Chief Chemist, Royal Plating & Polishing Company, Newark, N. J.

The author describes plating procedures on full automatic and semi-automatic plating equipment in one of the largest job shop plating plants in the country. Preparation of the metal in successful stainless steel and monel metal plating is also described and functions of the laboratory in the job shop given.—Ed.

THIS article is dedicated to the job shop platers and foremen and supervisors of manufacturers' plating departments who can plate almost anything asked of them, but do not want to become involved in long and technical discussions about why and wherefore.

This work is a far cry from the early days of plating. The sloppy, hole-in-the-wall job shop has been replaced by a highly efficient, modernly equipped, safely constructed plant. Complete automatic plating units as well as semi-automatic and still tanks, automatic polishing machines, plating processes of the latest development all may be found in the new job shop, and we find a laboratory too, for plater and the chemist now understand each other. Who can say that the job plater did not do his share during the recent World War II? The genius of a plater, whether he be a job plater or manufacturer's plater, is brought out when we look at the variety of shapes he was called upon to plate during that period. If

he was fortunate enough to have a plating chemist at the plant, he had some technical advice and assistance, which was of value. On the other hand, if he was alone, he had to resort to his own ingenuity and information obtained at society meetings or publications containing literature referring to electroplating in general. The plater's continual thirst for knowledge and information makes the plating chemist easy prey for his questions. The answers must be clear and concise, in language easily understandable and free from technical terms which are strange to him.

Royal Plating and Polishing Company is a high production job plating plant. It is large enough to contain two completely automatic plating units for copper and nickel buffing lathes and other equipment, utilizing 75 to 100 men. Semi-automatic units for copper, nickel and cadmium; still tanks for zinc, cadmium, nickel, tin, copper, gold, silver, brass, chromic acid anodizing and dyed anodized coatings in various colors; spraying and lacquering, rack coating and insulation, barrel plating with overhead rail systems for cadmium, zinc and nickel are the operations performed in this plant.

## Plating Brass on Automatic Equipment

For example, the plating of brass auto antenna tubes will be followed through the plant. These are



Figure 2. Automatic buffing machine for polishing brass tubes.

supplied in the raw state heavily oxidized and discolored by the last annealing operation put on by the supplier. The tubes are pickled in 100% muriatic acid for 10 minutes until the heat scale and oxide is in a loose and easily removable condition. A bright dip using 2 parts nitric acid and 1 part sulphuric acid puts the tube in condition for polishing, which is done on an automatic tube polishing machine. Racking is taken care of by girls and the nickel plating cycle as set up in the complete automatic plating machine is performed.

The first step, to follow the work in detail, is direct cleaning in a proprietary cleaner, using 6 ozs. per gallon, temperature 180° F to 210° F, time 1 minute, 6 volts. The work is then transferred to the next tank and treated with another cleaner, 6 ozs. per gallon, temperature, 180° - 210° F, 6 volts, time 5 seconds, using reverse or anodic current. Mention is made at this point of a timing switch which regulates the time in seconds for reverse or anodic cleaning. Also note that there is no water rinse between cathodic or direct cleaning and anodic or reverse cleaning, although separate tanks are used.

Such cleaning is followed by a water rinse with spray nozzles at the withdrawal end for 30 seconds from where the work goes into a sodium cyanide solution dip at room temperature for 85 seconds at 4 oz. per gallon concentration. The sodium cyanide dip is followed by 3 successive water rinses, all having spray nozzles; time, 30 seconds. The last dip before going into the nickel plating solution is for 30 seconds in 1% sulphuric acid solution, which is changed and renewed after each 24 hours operation. Nickel plating is done in a proprietary bright nickel solution, capacity 1950 gallons for 15 minutes, which gives a deposit thickness of .0003". Two water rinses follow and a hot air drier completes the nickel auto-

matic cycle. The dried parts are unracked and delivered to the chromium plating department for re-racking and chromium plating.

The need of re-racking for chromium plating may be questioned; the reason is due to the difference in design of the two racks, as it is possible to plate twice as many tubes with nickel as with chromium. On many other items, such as electric iron tops, it is possible to go directly into the chromium plating solution without re-racking. In this case, it is necessary to strip the rack of chromium and neutralize all traces of chromic acid in a caustic soda solution containing up to 10 ozs. per gallon. Sodium hydrosulfite is also effective in making chromic acid harmless, so if you dip your rack in a water solution of this salt 1 to 2 ozs. per gallon, it will help to keep you out of trouble. Incidentally, if chromic acid contamination is suspended in the cleaning cycle, a quick and temporary adjustment can be realized by adding about an ounce or two for each 100 gallons of solution suspected. Sodium hydrosulfite is especially effective in copper cyanide strike and plating solutions and mild alkali cleaners. Of course, after chromium plating, the parts are thoroughly rinsed in two cold running water rinses, a hot water rinse and hot air dried.

#### Plating Steel on Automatic Equipment

On a similar type complete automatic unit, steel is copper plated after the usual 180 emery grease finish. The first operation is racking and the parts are hung on the conveyor. The cleaning operation is well taken care of in heavy duty steel cleaner at a concentration of 6-8 ozs. per gallon and temperature of 180 - 200° F. Reverse or anodic current is used for 1½ minutes and 8 volts. A water rinse follows and a 1 minute dip in 50% muriatic acid completes the preparation before plating. A water rinse and

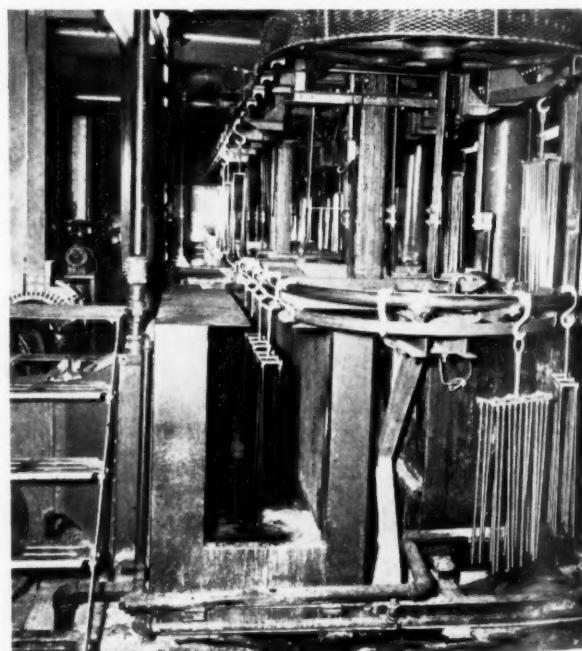


Figure 3. Completely automatic bright nickel plating machine.  
Note parts in drying zone.



Figure 4. Copper plating steel electric iron tops in another of the full automatic plating machines.

spray is next, followed by a copper cyanide strike solution for 1½ minutes with the following composition: copper cyanide, 4 ozs. per gallon; sodium cyanide 6 ozs. per gallon, temperature 140° F.; free cyanide 1½ ozs. per gallon, 6 volts.

Following the cyanide strike are two water rinses with spray nozzles to insure complete and thorough rinsing and prevent the possibility of cyanide drag-in to the copper plating solution. The copper plating solution of 1950 gallons is the copper pyrophosphate type, which has successfully produced semi-bright and ductile deposits over a period of 2½ years. .0006" to .0008" of copper at approximately 50 amp. per sq. ft. in 25 minutes has been deposited. After thorough rinsing and drying, the parts are copper buffed and polished.

On many not critical items, it has been possible to eliminate copper polishing and go directly to bright nickel. However, electric iron tops, automobile horn rings and toaster parts all are copper buffed and polished before bright nickel plating. Buffing costs are considerably lower when using bright, high speed copper solution as compared with acid copper deposits, or deposits obtained from a Rochelle salt type copper cyanide solution.

The parts are racked after copper polishing and nickel plated on the complete automatic unit for

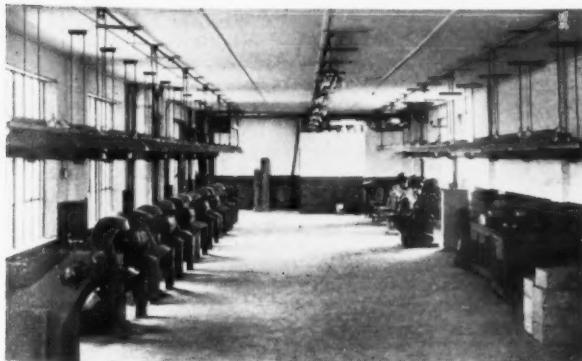


Figure 5. New buffering department; an addition to present capacity.

bright nickel plating as already described. They are thereafter chromium plated.

#### Plating Zinc Base Die Castings

Zinc base die castings are plated in semi-automatic conveyors and the cleaning is done by hand as follows:

1. Soak in emulsion cleaner for two minutes, cold water rinse and hot water rinse.
2. Alkali clean in proprietary cleaner. Reverse or anodic current 15 seconds 6-8 Volts. Water rinse.
3. Dip in 2% muriatic acid and water rinse.
4. Copper strike in copper cyanide strike solution as described above and three water rinses.
5. Copper plate in copper pyrophosphate solution 1600 gallon capacity. Time 15 minutes at 35 amp. per sq. ft. Approximate thickness .0003".
6. Water rinse.
7. Dip in 10% sulphuric acid solution and water rinse.
8. Nickel plate in bright solution, capacity 1350



Figure 6. Inspection department with the laboratory in the background.

gallons, semi-automatic for 12 minutes at 30 amp. per sq. ft. Thickness approximately .0003".

9. Water rinse.
10. Chromium plate 3 minutes, rinse and dry.
11. Strip racks and neutralize chromium acid before racking again.

#### Plating Stainless Steel and Monel Metal

It has been the lot of the job plater to be called upon to plate many difficult metals or types of metals. Among these are stainless steel and monel. It is not important to the plater to know the exact composition or percentages of ingredients in stainless steel. Most platers know it is a tough job and know also that it contains chromium. The same is true of monel, only it is a different breed with no iron or chromium, but containing copper and nickel. These metals are plated in the following manner.

All monel auto aerial tubes are nickel plated on the

complete automatic unit. The same cycle is used as described for brass and copper with one exception, and a very important one. Reverse or anodic cleaning for monel metal is not used because rejects due to peeling or blistering upon bending will result. In view of the fact that separate rectifiers are used for each cleaning tank, that for anodic or reverse current is shut off and only cathodic or direct current is used for cleaning monel at 6-8 volts.

Stainless steel is cleaned cathodically in proprie-

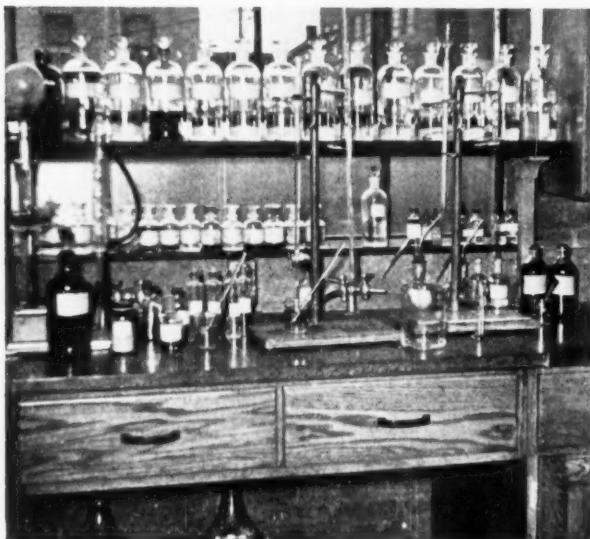


Figure 7. View of analytical section of laboratory.

tary cleaner, water rinsed, 50% muriatic acid dipped, water rinsed and flashed in the following solution:

Nickel chloride—32 Ozs.  
Muriatic acid—1 Pint  
Water—1 Gallon  
Voltage—6 Volts  
Room Temperature  
Nickel or Carbon Anodes  
Time—30 seconds to one minute.

The work is water rinsed and nickel plated in the semi-automatic unit, capacity 1150 gallons.



Figure 8. View showing section for plating tests with rectifier, hot plate and solution agitator. Note magnetic thickness tester and section of salt spray cabinet to left.

### Conclusion

We have here briefly described only a small portion of the plating activities contained in the modern job shop. A very important and necessary part of such activity is a well equipped and efficient laboratory.

The Royal Plating and Polishing Company laboratory is an important part of the plant. Analytical control of all solution, is, of course, one of its most important functions. Here also is contained apparatus for thickness of deposit tests by drop methods and magne-gage, pH meter of the glass electrode type, laboratory rectifier for plating tests, Hull cell, salt spray cabinet, surface tension testing apparatus, analytical balance and reference books; all under the supervision of trained plating chemists. New processes are investigated and developed, plating problems are solved, racks are designed. The plater learns that it is the beginning only, for both he and the chemist know that what worked well in the laboratory can be a complete failure in the shop. However, with close cooperation and a bit of tact and understanding on the chemist's part, what started in the laboratory can end well in the shop.

# Rectifiers for Electroplating—Part IV

By Louis W. Reinken, Chief Engineer, W. Green Electric Company, Inc., New York City.

## Auxiliary Circuits

In PREVIOUS articles we have discussed basic rectifier circuits, voltage control systems, and the need for ventilation (fan-cooling) of high current rectifiers. In addition to the major components discussed:

Rectifier elements;

Transformers, including voltage control;

Fans;

most rectifier equipment incorporates also such auxiliaries as:

ON-OFF control.

Protection.

Meters.

## ON-OFF Control

The simplest ON-OFF control would be a manually-operated switch in the circuit between the AC source and the rectifier unit. This is used only in small, cheap, single phase units. Most single phase rectifiers are equipped with a circuit breaker switch which serves as the ON-OFF control and also limits the amount of current drawn from the AC source by automatically tripping open if the current exceeds a predetermined level. A certain measure of protection is thus built-in since the circuit breaker is generally designed to trip open at currents slightly in excess of the current normally drawn at full rated output current, and full rated output voltage.

The circuit breaker does not, however, provide complete protection against overloading of the rectifier. This is an important point and is worth explaining. The following will make clear why a circuit breaker in the AC input circuit cannot provide protection against overload in the DC output circuit:

### HYPOTHETICAL SINGLE-PHASE RECTIFIER UNIT, 6 VOLTS—100 AMPERES

Condition	DC Volts	DC Amps.	DC Watts	Efficiency	AC Watts	AC Amps.*
A	6	100	600	60%	1000	9—
B	3	150	450	50%	900	8—

(\* at about 112 volts)

The above table represents a single-phase rectifier unit operated, in Condition A, at its full load rating of 100 amperes and 6 volts, and in Condition B, at 150 amperes but at 3 volts. It will be noted that in Condition B, although the rectifier is loaded to 50% above its rating of 100 amperes, the AC current is

less than with a load of 6 volts—100 amperes, and therefore no circuit breaker protection is possible under this condition.

Similar reasoning applies to large three-phase rectifiers—neither fuses nor thermal cutouts can protect the rectifier if they are inserted immediately following the AC supply source. However, such current limiting devices are desirable and required by the Electrical Code, in order to limit the maximum current which may be drawn from the supply line.

Three-phase rectifier units are usually equipped with magnetic contactors, which are simply switches operated by electromagnetic solenoids, instead of manually. If the contactor is equipped with an auxiliary "holding contact," it is a simple matter to turn the rectifier ON or OFF from one or more push button stations. The push button circuits are required to carry only a small current, and if the contactor solenoid coil is designed for 110 volt operation, the voltage in the push button control circuit is also comparatively low. This simplifies the remote ON-OFF control problem since the main AC supply (which may be 220 or 440 volts, three-phase, at 100 amperes or more) need connect only to the rectifier contactor and not to the control push buttons.

If a pilot lamp is used to show when the rectifier is "ON," it is desirable to derive the pilot lamp voltage (directly, or through a small transformer) from across the fan motor since this will at least show that this vital component is receiving its required voltage.

## Protection

As explained in the foregoing, protective devices in the AC input circuit will not always provide protection for the rectifier elements against overload in the DC output circuit. The rectifier elements should be protected against (1) abnormally high temperatures which may result from ventilation failure, (2) unusual local temperature conditions, and (3) load current in excess of the rectifier rating.

In single-phase rectifier units of the natural-cooled type (no fan), considerable protection is provided by a fuse in the output circuit which matches the maximum current rating of the rectifier. Theoretically, by blocking up the ventilation openings of the rectifier cabinet and operating at maximum current rating, it should be possible to damage the rectifier before blowing out the fuse. In practice, the output fuse has provided excellent protection for the small rectifier unit, and in those comparatively few cases

where rectifier breakdown has occurred, the primary cause has generally been found to be an accident—such as dumping a quart or two of plating solution into the rectifier assembly.

In larger three-phase units, fuses would not be entirely practicable (at ratings of several thousand amperes) and other factors such as fan operation and ambient temperature are also important. In practically all larger units, of whatever make, the coil circuit of the magnetic contactor is associated with the protective devices as a convenient means of interrupting the main AC power supply circuit to the rectifier unit.

In one type of rectifier,\* thermal cutouts are inserted between the voltage control switches and the main transformer. These thermal cutouts are standard devices which employ, essentially, a low resistance heating coil and a bimetal strip contact which will open the coil circuit of the contactor when the current through the heating coil exceeds a predetermined value. Since the current in the primary circuit of the main step-down transformer is approximately proportional to the DC output of the rectifier, this provides a means for limiting the maximum current drawn from the rectifier. A second thermal cutout device is located in the supply circuit to the fan motor so that excessive current in this circuit (due to shortcircuit in the motor, for example) will also open the main contactor.

The protective system described above, provided the thermal cutouts are carefully selected, will provide considerable protection against excessive load current.

In another type of rectifier unit†, particular attention is paid to protection of the unit against failure of the fan or interference with the air flow. An ingenious airswitch is incorporated which will hold the contactor coil circuit closed so long as adequate air flow maintains pressure on the vane of the airswitch. Failure

\* Udylite-Mallory.

† General Electric.

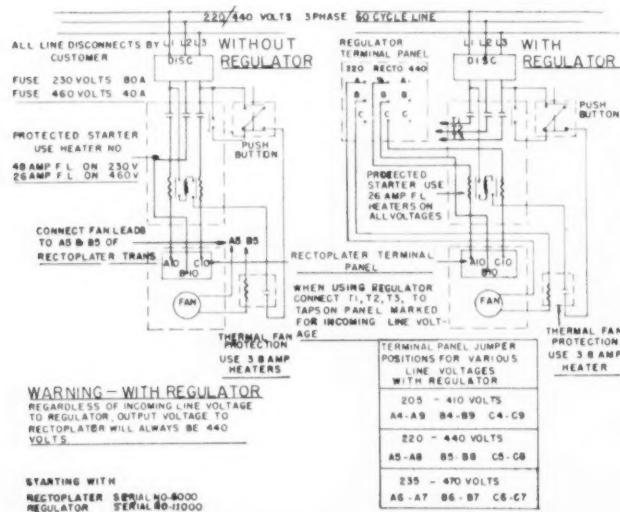
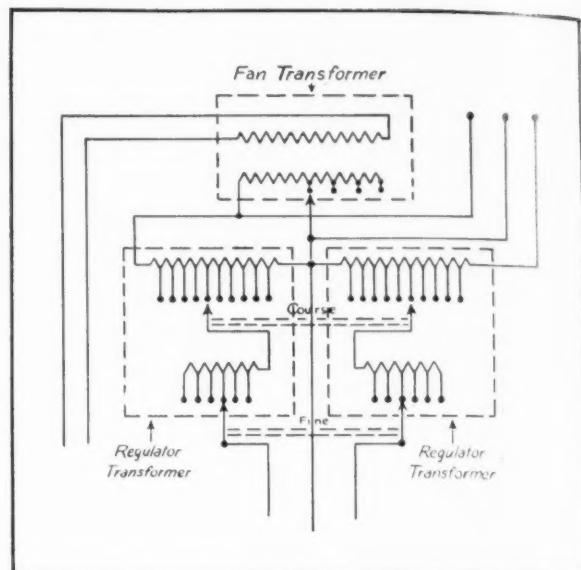


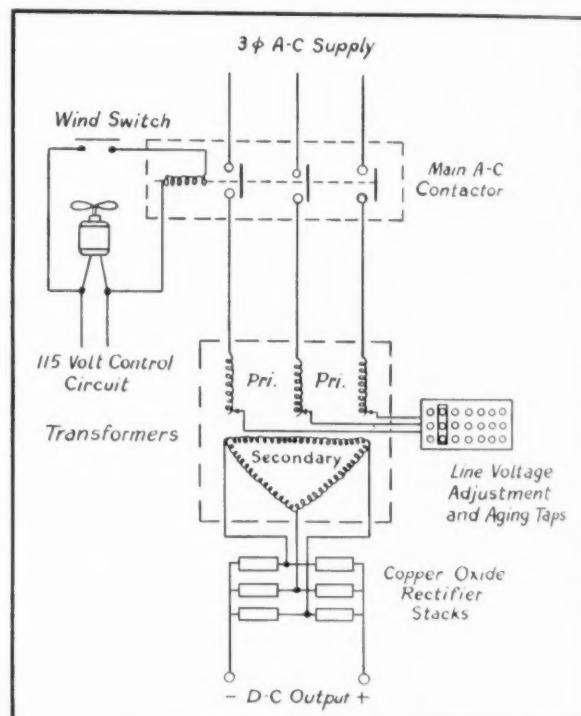
Figure 23. Illustrating first rectifier\* system described in text.



(A) Regulator unit.

Figure 24. Showing second rectifier† system described.

(B) Rectifier unit.



of the fan motor from any cause, or blocking of the air intake or exhaust ports, will cause the airswitch to open the contactor coil circuit, thus shutting down the rectifier. When starting a rectifier unit equipped with such a device, the ON button must be held closed for a few seconds until the fan has come up to speed and closed the airswitch in parallel with the ON button.

This system ensures that the rectifier‡ may not be operated if ventilation is faulty.

In a third type of fan-cooled rectifier unit, the protective system is based on the actual temperature of

‡ Green Electric.

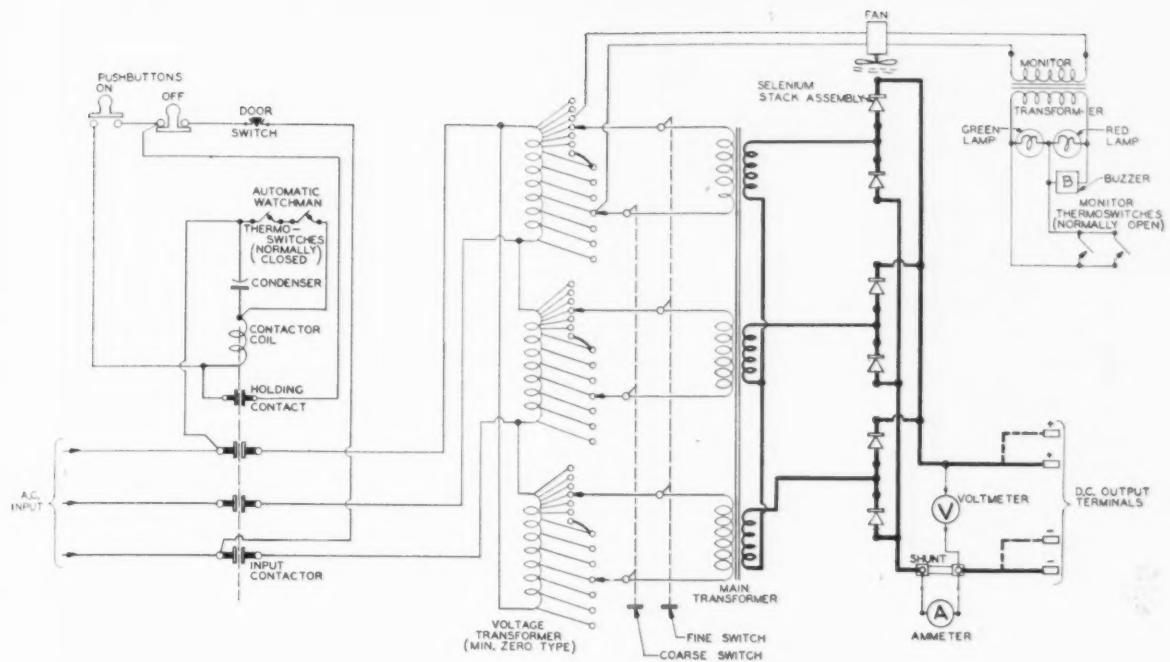


Figure 25. The third type of rectifier hookup described.

the rectifier elements. Several thermostats are located as close as possible to the rectifier elements and respond to the temperature of the air which, in turn, depends upon the temperature of the rectifier plates. The thermostats are grouped in pairs, the number of pairs depending upon the size of the unit and the number of individual stacks (plate assemblies) in the unit. In each pair, one of the thermostats is associated with a warning circuit which extinguishes the green pilot lamp, lights a red warning light, and sounds a warning buzzer.

The second thermostat in each pair, set for a few degrees higher temperature, will operate if the temperature continues to rise and will open the main contactor if the preliminary warning signals are ignored.

This system, based on rectifier temperature, is intended to take into account the several factors (load current, local temperature, ventilation) which together determine the rectifier plate temperature, and to provide a warning preliminary to actual shutdown of the power supply to the plating tanks.

#### Meters

Most rectifier units include a DC voltmeter and a DC ammeter, either in the rectifier cabinet itself if of the self-contained single-unit type, or in the remote control (regulator) box if of the two-unit type. In the latter arrangement, leads must be extended from the meters to the tank busbars and the ammeter shunt. The shunt may be located at any convenient series point in the busbars between the rectifier terminals and the tank, but the voltmeter leads should preferably connect directly across the tank if the busbar run is lengthy, so that the voltmeter will indicate actual voltage across the tank rather than across the

rectifier terminals. This will eliminate error due to voltage drop in the busbars.

Ammeter instruments operate from the comparatively small potential developed across the ammeter shunt, usually .05 volt maximum, and therefore are subject to error if any appreciable voltage drop occurs in the leads between the shunt and the ammeter instrument. For short distances, up to 5 or 6 feet, standard ammeter leads may be used; but for greater distances, the cross-sectional area of the conductors should be correspondingly increased. The rectifier manufacturer should be consulted for recommendations if the instruction booklet does not cover this point.

Industrial meters of the type used on rectifier equipment are usually calibrated to within a tolerance of plus or minus 1 or 2 percent of the maximum reading of the meter. Consequently, at small deflections the possible error is a higher percentage of the reading. If accurate readings are essential at voltages or currents much lower than the full scale calibration, means should be provided for switching in an auxiliary meter with a lower fullscale value. This is generally more practicable and more economical than specifying that the rectifier should be specially equipped with delicate meters calibrated to laboratory standards of accuracy.

#### Automatic Control—Time

The simplest automatic control which can be associated with a rectifier power supply system is a special clock to shut down the rectifier after a predetermined interval, or to give an alarm signal, or both.

Clocks of this type are made by a number of manufacturers in springwound form for short intervals, or with electric motors for long or short inter-

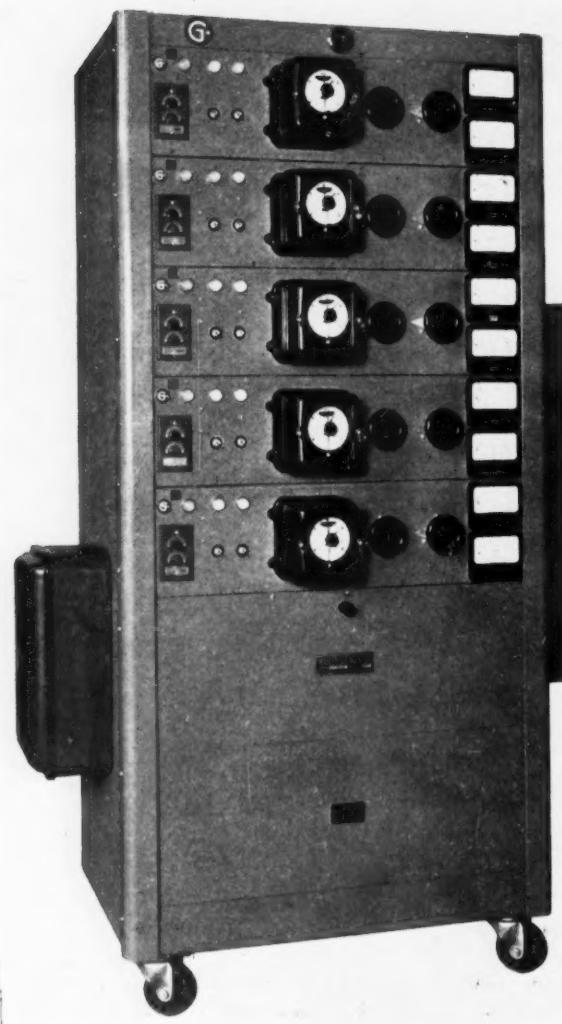


Figure 26.

vals, and vary considerably in cost depending upon the features desired.

The simplest arrangement is a clock which may be manually set to open a built-in switch after the desired time has elapsed and to cut this switch into the coil circuit of the rectifier unit contactor. More elaborate clocks are of the "recycling" type, which will reset themselves and repeat the timing operation simply by pressing a control button.

Still more elaborate "clocks," which may cost several hundred dollars, are program timers which permit as many as six or eight circuits to be independently opened or closed, each at a separately predetermined interval. A program timer may be used for automatic control of anodizing where the power supply is made up of a bank of six or eight rectifier units connected in series, as described in Part III. With this type of control, the voltage may be progressively increased at intervals as desired, concluding with automatic shutdown of the power supply and a simultaneous alarm signal at the end of the process.

In general, control clocks and program timers are equipped simply to close or open pilot control circuits so they are most easily suited to starting or stopping rectifier units by closing or opening the contactor coil circuits directly or through relays.

#### Automatic Control—Amperehours

Amperehour control is similar to straight time control, excepting that the automatic shutoff or signal (or both) occurs after a predetermined quantity of amperehours has passed rather than a predetermined period of time. Assuming that the plating process is maintained reasonably constant in all other respects (operating voltage, bath temperature, bath composition), then the thickness of deposit can be closely predetermined by the setting of the amperehour meter.

Amperehour meters resemble watt-hour meters superficially, but may be more accurately described as DC motors whose speed is proportional to the voltage applied across them, and which derive this voltage from an ammeter shunt. In other words, the motor of the amperehour meter increases its speed in proportion to the tank current flowing through the shunt.

Amperehour meters are supplied complete with their own shunts, which develop 75 to 100 millivolts maximum, and their own shunt leads. They may not be used in conjunction with standard 50 millivolt ammeter shunts, but it is possible to order special ammeter instruments to be used across the shunt supplied with the amperehour meter, thus avoiding the cost of a second shunt for the ammeter.

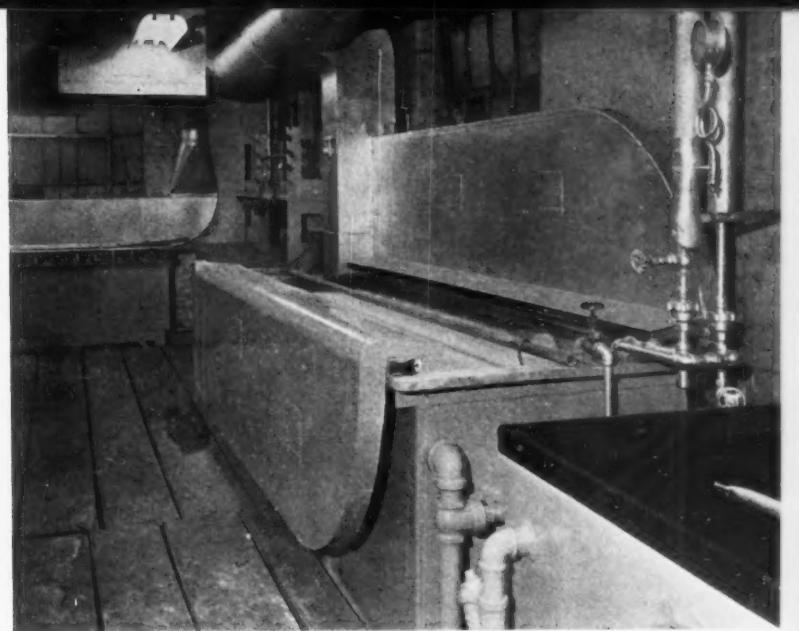
When specifying amperehour meters, direct or through the rectifier manufacturer, at least three items must be indicated:

- (1) Maximum *amperes* to be passed through the shunt—i. e., 1000 amperes, 1500 amperes, etc. This determines the shunt size.
- (2) Maximum *amperehours* to be covered by one rotation of the indicating pointer—i. e., 100 amperehours, 500 amperehours, etc. This determines the gear ratios to be incorporated in the amperehour meter.
- (3) Distance between amperehour meter and shunt, if greater than five feet. Standard leads supplied with the amperehour meter are five feet long. For greater lengths, special leads of heavier copper must be supplied and the resistance must be closely controlled since this will affect the accuracy of the amperehour meter.

If an amperehour meter is to be built into the original rectifier equipment, the following flexible arrangement of control switches should be considered:

- (1) Amperehour meter cut out of circuit. Manual control.
- (2) Amperehour meter to provide visible or audible warning signal (or both) at end of desired amperehours. Pilot lamp to show that this arrangement has been set up.
- (3) In addition to (2), automatic shutoff at end of predetermined amperehours. Second pilot lamp also illuminated to show that shutoff, as well as signal, will occur.

Figure 26 illustrates a centralized remote control unit for control of five different rectifier units, with independent amperehour control of each rectifier unit.



(Courtesy National Safety Council)  
Slot type ventilation for plating tanks.

## Toxicity of Chemicals in Electroplating

*Continued*

By P. M. Van Arsdell, *Benson & Associates, Chicago 4, Ill.*

A NUMBER of symptoms have been observed when even low concentration of chromic acid (5%) have been used in anodizing solutions. These consist of ulceration of the nasal septum, particularly in those persons having spurs or deflections of this structure, and skin rashes. No one escapes some involvement. The ulceration and perforation of the septum proceeds with very little disturbance and usually the case may be far advanced before aid is sought. Bleeding, scabbing, dryness, and nasal irritation are the only symptoms which may be delayed for some time in their appearance. The hydrogen evolved in this type of bath is responsible for carrying the chromic acid into the atmosphere. Adequate exhaust ventilation, 134 feet per minute per square foot of tank area, is the best means of eliminating this hazard.<sup>27, 79</sup> However, as a temporary means of guarding against possible nasal injury, a heavy ointment consisting of 75 per cent petrolatum and 25 per cent lanolin may be used if applied to the nostrils several times daily when only temporary contacts of the acid containing atmospheres are necessary. When the contact is prolonged, respirators of an approved type for chromium containing atmospheres should be used.

When the hands and other exposed portions come in contact with the plating solutions, ulcerations known as "chrome holes" slowly develop which are deep and painful. The skin may be entirely removed, particularly at the knuckles and at the base of the nails. The

tissues show scars when the scab is sloughed. In addition to the dermatitis, certain individuals have been known to develop allergic reactions to the chromates; these consist of asthma, fever, nephritis, and the like.<sup>38</sup>

Chromic acid has proved especially dangerous on skin contact with concentrated solutions. It has been reported that workers receiving splashes in the face have died as a result of the exposure.<sup>23</sup> Chrome ulcers should be treated immediately as they may spread and continue for long periods; they are likely to become the focal points of secondary infection, and every skin break should be carefully treated to prevent the entry of chromium. With care these heal completely, but persistent scars remain.<sup>65</sup> For proper cleansing after contact with any chromium compounds, a wash of five per cent sodium thiosulfate, "hypo," solution in water should be used. As a protective measure, rubber gloves, aprons and boots should be worn. Protective cream on the hands before putting on the gloves will aid in preventing dermatitis reactions in the event a glove is punctured during operations.

Ingestion of chromates may occur accidentally—a splash entering the mouth. The symptoms of such type of contact are sore throat, disagreeable taste, vomiting, pain, diarrhea, collapse and unconsciousness with dilated pupils; slow respiration and muscular cramps. Less than 0.5 grams (dry) of potassium dichromate may cause serious poisoning; while the

lethal dose is below eight grams. Six grams of chromic acid may be fatal. Depending upon the amount swallowed, the reactions may appear as follows: kidney damage with blood and albumen appearing in the urine, nervous symptoms such as headache, stiffness at the back of the neck and muscular cramps. In serious poisoning through this route, hemorrhages in stomach, intestines and respiratory tract are also present.<sup>65</sup>

First aid treatment consists of prompt evacuation of the stomach by such quick acting emetics as mustard water, or ipecac, or zinc sulfate (15 to 30 grains in a glass of water) and washing the stomach thoroughly. The individual should be kept warm and a doctor promptly summoned.<sup>49</sup>

As a further precaution in handling chromium vapors, the exhaust ventilating systems should periodically be thoroughly cleaned with water to remove the dry chromium compounds which collect. These are oxidizing agents and are apt to cause serious fires when lint or organic vapors contact them. The entire plant can be seriously endangered from a fire in the exhaust systems.

### Cobalt Compounds

Chemically the salts of cobalt resemble those of iron and nickel, but are not nearly so toxic.

Salts of cobalt may cause an allergic dermatitis which may be ascribed to a chemical reaction with some specific complex molecule in the skin cells.<sup>67</sup>

On inhalation, cobaltous acetate salts produce nausea, vomiting, colic and fever. The stomach may show sensitiveness on pressure and the blood and urine show some slight symptoms of damage. However, removal from the atmosphere is usually sufficient to bring about recovery.<sup>28</sup> Respirators should be worn when dusts or fumes of cobaltous or cobaltic salts are present.



(Courtesy National Safety Council)  
What not to do—healing for an eye injury.

Ingestion of cobalt compounds in concentrated form causes nausea and vomiting.<sup>28</sup> Muscular jerking which is uncontrollable may also be present.<sup>41</sup> According to some opinions, the toxic action on ingestion would seem to be more on the central nervous system than on the motor nerve endings. It is believed that nickel and cobalt paralyze to some extent the fore brain. The action is more nearly referable to that of barium and platinum than to iron which is distinctly different.<sup>61</sup>

Treatment consists of washing the stomach thoroughly and administering laxatives. A physician should be consulted if symptoms persist.

In comparison with nickel, cobalt is much less toxic in its effect. Fatal doses in animal experiments have shown that nearly three times more cobalt than nickel are necessary to produce like results.<sup>15</sup>

### Copper and Copper Salts

Copper sulfate and copper cyanide are the two most extensively used salts in electroplating. However, occasionally the chloride, nitrate, carbonate, or acetate may be encountered. With the exception of the cyanide salt which is a violent poison, these salts act only as astringents and may be somewhat caustic on contact with the mucous linings of the nose and throat. Absorption of copper by the body is low and the effects are generally not cumulative.

Skin contacts with copper sprays with the exception of the cyanide react in the following manner—eczema-like eruptions appear in susceptible individuals<sup>21</sup> and copper itch<sup>64</sup> has been reported but its incidence is questioned by most observers. Should severe dermatitis develop, a doctor should be consulted. The best means of prevention of skin reactions are constant attention to cleanliness and the use of protective gloves and aprons.

Upon ingestion copper salts produce a metallic taste, constriction in the throat and gullet, gripping pains in the abdomen, nausea, vomiting, purging with much straining, partial suppression of the urine and jaundiced skin. The breathing may be rapid and difficult; the pulse small and quick. When poisoning is severe there may be some kidney damage, great weakness, intense thirst, cold perspiration and marked coldness of the arms and legs, headache, giddiness, coma and death. Authorities differ on the questions of cumulative toxicity of copper on ingestion, however should chronic copper poisoning develop, a green line may appear on the gums, and there may be muscular weakness and cramps.<sup>49</sup>

Copper sulfate is usually a prompt and effective emetic; its action is preceded by a short nausea.<sup>25</sup> It is extremely irritating to the digestive tract and should the emetic action fail to appear, immediate vomiting should be induced. The stomach should be washed to insure the removal of the compound.

First aid procedure on ingestion of copper salts consists of inducing vomiting as quickly as possible if it is not already present by the use of mustard water or ipecac,<sup>49</sup> keeping the patient warm and calling the doctor.

When purifying copper electrolytically contamin-

ants such as selenium gold or silver are often encountered. Of the three, selenium is the more dangerous as it combines with the hydrogen forming hydrogen selenide. This compound is somewhat analogous chemically to hydrogen sulfide in its toxic action, although from reports, it does not seem to be so rapidly fatal. This compound has the odor of garlic. In animal experiments, it has been noted that there is olfactory fatigue when the concentration is of the order of 0.001 mg. in the atmosphere.

For workers, when the concentration is 0.005 mg. per liter of hydrogen selenide or over, the eye and nose irritation is too severe for working. When accidental inhalations occur, findings have shown that this compound is sufficiently damaging to cause pneumonia which may persist in an acute form.<sup>19</sup> Inhalation sometimes causes pain in the abdomen, vomiting and pain in the lumbar region, but not commonly.<sup>20</sup>

For the more chronic symptoms, it has been found that there is early liver damage marked by fatty deposits which later subside. Spleen changes are also shown which progress to a moderate degree.<sup>19</sup> Persons in contact with the selenium compounds are often bothered with garlicky breath. This is caused by the formation of methyl selenide within the body from any selenium which may be present.<sup>20</sup>

### Gold Compounds

Gold plating is usually done with the cyanide or the chloride bath.<sup>21</sup> Either of these salts of gold are poisonous, although the cyanide is much more toxic than the chloride. Because of the economics involved when vapors or sprays escape to the atmosphere and the difficulty of reclaiming from a diffuse area, great care is exercised to prevent any carry out of the solution either by vapors or by objects from the bath.

So far as toxic reactions of workers are concerned, little appears in the literature to substantiate or disprove any industrial poisoning which might be claimed. The soluble salts of gold are actively poisonous. Their toxic effects like those of the mercury salts appear to be due to their local irritating action on the alimentary canal and on the kidneys.<sup>22</sup>

The chemical findings when gold salts have been used in the blood stream of rheumatic individuals would lead to the expectation that if gold salts entered the blood stream of workers through chapped hands or open sores, the toxic reactions would reflect in kidney disturbances and others of varied nature. Generally gold salts are poorly absorbed in the digestive tract. Only when they directly enter the blood stream are toxic symptoms shown and because of the nature of these it has been concluded that gold salts act as vascular poisons only.<sup>23, 24</sup>

### Iron and the Ferric Salts

Iron plating is limited in its application at present, but electroforming and electrowinning have recently met with renewed interest. The sulfate and chloride salts are generally used when iron plates are deposited.<sup>25</sup>

Physiologically the soluble salts of iron precipitate



(Courtesy Benson & Associates, Inc.)  
Eye washing fountain for chemical eye contacts.

proteins and their reaction on contact with living tissue may be astringent, irritant and corrosive. Accidental inhalation of vapors from iron plating baths may have a drying and highly irritating effect on the mucous linings of the nose and throat although no actual cases have been reported.

When ferric chloride enters the alimentary canal, irritation is produced almost immediately with vomiting and diarrhea being the initial symptoms of toxicity. The stomach inflammation may persist. Corrosion of the teeth is also a sign of ferric ion reaction. Ingestion should be treated by the administration of sodium bicarbonate as a stomach wash and the vomiting reaction induced if not present.<sup>26</sup> Persistent inflammation or symptoms should be treated by a physician.

### Lead and Lead Salts

Commercially, lead plating is conducted by the use of fluosilicate and fluoborate baths although it has been deposited from a varied number of solutions among which are acid solutions of nitrate, acetate, perchlorate, oxalate, dithionate, sulfamate and alkaline solutions of plumbites and cyanides.<sup>26</sup>

Physiologically, inorganic lead and its compounds are absorbable from all mucous membranes and exposed tissues. These compounds enter the body mainly by inhalation and ingestions and the effects are cumulative. Absorption by the intact skin may also be a mode of entry on prolonged contact as the compounds may enter through the hair follicles or through chapped or scratched skin.

Conjunctivitis may also develop if lead solutions, vapors, or spray contact the eye tissues. All workers handling lead in any form should use rubber gloves, respirators and goggles to prevent contacts.

Inhalation of lead containing vapors is the most common route of poisoning. Lead poisoning may be either sub-acute or acute depending upon the mode of entry, but the following symptoms are fairly common to both inhalation and ingestion. There is a sweet, then a metallic taste in the mouth and dry throat, followed by intensive burning and abdominal

pain within a half hour. Vomiting is usually followed by intensive diarrhea and later symptoms show an involvement of the kidneys as the urine becomes scant and albuminous. Foul breath, coated tongue, headache, pain and cramps in the legs appear in a few hours, and in extreme cases, collapse with coma may also occur. Death has occurred within thirty-six hours when extremely large amounts have been absorbed.

When symptoms of poisoning occur, a physician should be summoned immediately; in the meantime the following first aid should be instituted: Epsom salts or sodium sulfate using 15 grams to 1 pint of water should be given to wash out the stomach with vomiting kept up to insure a complete washing of the stomach. After this has been as thoroughly done as possible the same dosage of the sulfates should be given and allowed to remain in the stomach to aid in the formation of the relatively insoluble lead sulfate which can then be eliminated by the cathartic action of these salts.

When lead containing vapors are inhaled there may be some action on the brain marked by convulsions and followed by stupor combined with other symptoms. The above treatment is also used upon ingestion, as both inhalation and ingestion may occur simultaneously, due to some of the lead compounds, often as much as 70 per cent, being lodged in the naso-pharynx where they are either absorbed or swallowed. Lead poisoning seems to develop by inhalation more quickly than by any other route.<sup>52</sup>

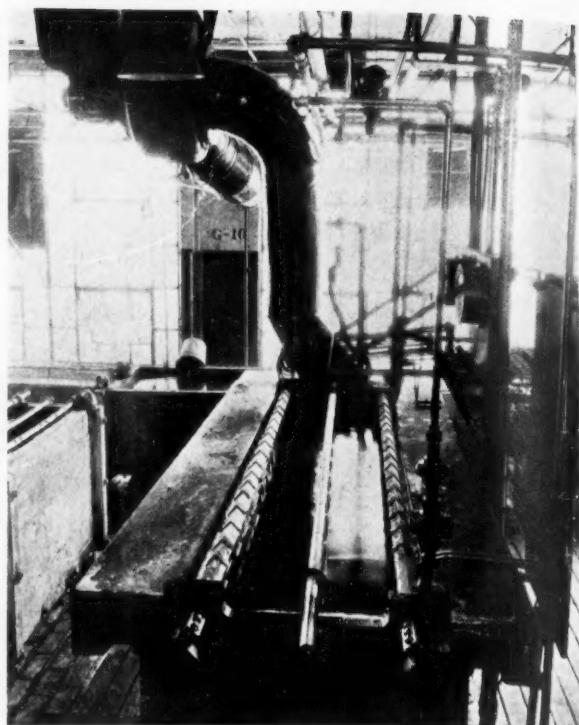
Sub-acute or chronic poisoning occurs when small amounts of lead are absorbed over a longer period and because the symptoms are quite diversified, may be mistaken for some other illness. The symptoms most universally present are weakness and continued fatigue, increasing loss of appetite with subsequent loss of weight, constipation, colic, muscular weakness affecting those muscles most commonly used, tremors of the eye, tongue and mouth and the occurrence of lead colic after the onset of all other symptoms. Extensive psychic changes also occur.<sup>46</sup> A physician should be consulted on the appearance or persistence of any of these symptoms in order that further injury may be averted. A full history of the exposure should also be given him.

Whenever minute quantities of lead are known to be present in the working area, routine urinalyses and blood counts should be made at frequent intervals.

Sub-acute symptoms usually disappear upon removal from the atmospheres containing the lead. There is a predisposition to lead poisoning however, which remains for a considerable period. Certain illnesses tend to cause recurrence of the lead poisoning symptoms as the lead is mobilized in the blood stream by the action of certain toxins or viruses from the disease producing organisms.<sup>52</sup>

### Mercuric Salts

Mercuric compounds are absorbed by inhalation, skin contact and ingestion. Some of the plating operations utilize mercuric salts as a prefinishing compound



(Courtesy National Safety Council)  
Photograph shows the complete ventilating and exhaust system on a chromium plating tank.

before final plating is done and there is considerable chance of poisoning if great care is not exercised.

Metallic mercury vaporizes even at ordinary room temperatures and whenever it is present there is danger from inhalation. Should large quantities of mercury vapor be inhaled, acute symptoms are experienced which are as follows—foul breath, metallic taste and an increased flow of saliva. Later symptoms include soreness with ulceration in the mouth, blackening of the gums and loosening of the teeth; the tongue may also swell and show ulcers. Still later a toxic kidney reaction occurs which is marked by scanty albuminous urine. When the poisoning is unusually severe, the teeth may be lost and a gangrenous condition of the jaw develop. Sub-acute or chronic mercury poisoning develops slowly and may result from constant exposure to the metal or its compounds, that is, the chloride or the nitrate. The symptoms are a progressive nervousness marked by irritability and muscular tremors and a tendency toward inflammation of the mouth and gums. As an early symptom of chronic mercury poisoning, it has been shown that the handwriting may be affected first. Signs of mercury poisoning are indicated by the omission of a letter either at the beginning or end of a signature, or the substitution of a letter similar in sound. These defects revealed in the handwriting are related to disturbances of the central nervous system and are caused by chronic mercury poisoning either existent or latent.<sup>32</sup>

For acute poisoning by inhalation, the individual should be removed from the contaminated atmospheres as soon as possible (the rescuers should wear gas masks to prevent their own injury) and a physician summoned as quickly as possible. As a pre-

liminary treatment, vomiting should be induced if not present by the administration of a warm mustard water emetic. Plenty of water for dilution and to stimulate kidney elimination and plenty of laxatives to promote bowel elimination are also recommended. Promptness is the keynote in treatment of acute poisoning as the mercury is quickly absorbed and fixed by the mucous membranes. According to one authority, the fate of the individual is practically decided within ten to fifteen minutes after absorption of mercury. Such customary antidotes as raw eggs, milk without cream, calcium sulfide and sodium thiosulfate are considered ineffective after the initial absorption period.<sup>51</sup>

Prevention of mercury absorption should be the rule. This may be accomplished by good ventilation throughout and all operations involving the use of mercury carried out under a hood.<sup>51</sup>

Mercury and its compounds are readily soluble in the body fluids, especially perspiration and also in the skin itself. Sufficient quantities may be absorbed in this way to produce sub-acute or chronic poisoning described under inhalation. When it is necessary that the hands contact either the metal or its compounds, gloves should be worn, but careful washing is necessary even on one contact. The metal salts are corrosive and irritating to the unbroken skin even in dilutions of 1 part in either 2000 or 4000 of water.<sup>64</sup>

Ingestion of mercuric chloride produces acute symptoms almost immediately characterized by a burning sensation in the throat, an astringent metallic taste in the mouth, a greatly increased flow of saliva, great thirst and abdominal pains. Vomiting occurs within a short time with white or bloody mucous shreds appearing in the vomitus. The systemic effects are coagulation, skin irritation and the corrosion of mucous membranes. When the poisoning is especially severe, great weakness, a weak rapid heart, fall in blood pressure, cramps in the legs, dehydration (due to excessive vomiting), stupor and collapse may also occur. As the poisoning progresses the kidneys and large intestines also show corrosion and destruction. Ingested mercury compounds should be evacuated from the digestive tract with all possible speed to prevent widespread tissue destruction.<sup>46</sup>

The emetic and other measures described under inhalation should be immediately used and the doctor summoned as soon as possible.

Clinically there are two different types of mercury poisoning; that of inhalation of volatile mercury compounds causing chronic nervous symptoms, and mercury intoxication with injury to the excretory organs as noted in the case of mercuric compounds and marked by salivation and kidney injury. Volatile organic mercury compounds are dispersed in the blood for a time while the salts undergo a combination with the blood and proteins of the organism.<sup>22</sup>

#### Nickel and Nickel Salts

Metallic nickel though widely used as a protective covering for many purposes is not considered a toxic element. However some persons are susceptible to

toxic reactions upon inhalation of nickel dusts. Throat irritation, usually slight, is the initially appearing symptom and the reaction may not progress further. Other symptoms such as weakness, fever, headache, nausea, muscle and joint pains may appear several hours after the first noticeable throat irritation. Recovery usually occurs within twelve to twenty-four hours.<sup>65</sup>

The nickel salts widely used in plating such as the chloride, nitrate and sulfate cause more widespread reaction among workers probably because of their greater solubility and more active state. When these salts or solutions are contacted by the skin for considerable periods, the familiar "nickel itch" or eczema occurs.<sup>18</sup> The irritation is first noticed on the fingers and forearms and considerable redness is the initial sign. Further contact causes some ulcerations with the sores usually appearing on the fingers but they may be present wherever damp clothing rubs the body. This condition is more prevalent in summer than in winter as sweating increases the susceptibility. Careful cleansing of all areas in contact with the solution is the best treatment. As a rule the first attack predisposes to a second, and heavy drinking is also sometimes a predisposing factor in the occurrence of the dermatitis.<sup>64, 76</sup>

Should ingestion of the nickel salts accidentally take place the primary symptom is vomiting. Plenty of water should be administered to aid the stomach to rid itself of the irritant.<sup>65</sup> Epsom salts in purgative doses help to clear the lower digestive tract of any accumulation of the irritant and should be given. If symptoms persist after the first aid treatment a physician should be consulted.

Eye treatment in the event of contact with splashes or sprays consists of copious irrigation with water and consulting a doctor.

#### Rhodium, Platinum and Palladium

Rhodium in spite of its rarity and fairly high cost has found a considerable application in the production of costume jewelry. Rhodium chloride is the salt most commonly used in plating operations. The metal is non-poisonous and the solution of the salt is only locally irritating.<sup>78</sup> In animal experiments even higher concentrations on injection have produced no systemic poisoning. Because of the local irritation, however, dermatitis may result when concentrated solutions come in contact with the skin.<sup>59</sup>

Metallic platinum is non-toxic, and never gives rise to occupational injury. The oxide which is rarely encountered in plating operations causes eczema of the hands and forearms and some lesions of the nails.<sup>14</sup> Dust and spray from the complex salts of platinum ordinarily used in plating have been found to cause asthma after continued exposure.<sup>33</sup> The initial symptoms of the reaction begin with repeated sneezing followed by a profuse running of the nose with a watery mucous discharge. Later reactions which may develop are tightness of the chest, shortness of the breath, with wheezing and blue coloration of the face.

(References appeared in the August issue.)

(To be continued)

## Electroplating by Brush

### PURPOSE

To deposit satisfactory metallic coatings without the equipment expenses involved in immersion plating by means of easy-to-operate, portable units.

### APPLICABILITY

Gold, nickel, silver, copper, cadmium or chromium may be deposited with comparative ease and simplicity on relatively small areas. The method is used extensively in home workshops, electrical shops, experimental laboratories, radio shops, garages and in a wide variety of manufacturing concerns.

### LIMITATIONS

Brush plating is intended as a supplement to and not as a replacement for tank and barrel work. It is only recommended for small areas and limited production quantities.

### EQUIPMENT

Cleaning—grease solvents  
polishing materials

Plating—prepared compounds  
specially designed brushes with  
suitable anodes  
current source—110-120 A.C., 50-60 cycle or No. 6 dry batteries

NOTE:—Make-shift units can easily be made in the plating room for use at the tanks, but to get full benefit of the portability of brush plating methods, it is advisable to utilize the inexpensive equipment manufactured especially for the purpose.

### PROCEDURE

1. Clean thoroughly, do not dry surface
2. Connect to electrical equipment
3. Rinse brush and dip completely into compound
4. Plate slowly, covering only a small area at a time

### GENERAL NOTES

It is estimated each brush stroke deposits approximately 0.0001 inch . . . thicknesses of 0.001 inch can be built without affecting the durability.

Brush plating is a valuable time saver on assembled items. Total weight of a complete kit would be about the same as a portable typewriter, thus the unit can be taken to the job with ease.

Current consumption is low—the unit operates at low voltage and at very high current densities, the compounds having a very high concentration of metallic salts.

Bright, satin and flat finishes may be secured by variations in the polishing standards achieved prior to plating.

# Shop Problems

Abrasive Methods—Surface Treatments—Control  
Electroplating—Cleaning—Pickling—Testing

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

## Jewelers Strip

**Question:** We are having a little difficulty in stripping or taking the fire out of gold and silver work after they have been enameled before we polish. I wonder if you could help us with some suggestions on the proper method.

S. G.

**Answer:** We suggest that for jewelers strip you use the following:

Copper cyanide — 2 oz./gal.

Sodium cyanide — 4 oz./gal.

Temperature 200° F. — reverse current 6 to 12 volts.

## Stripping Solution

**Question:** What solution strips chrome and nickel from zinc-base metals, without damage?

In a bright copper bath, the current drops after a minute or two to less than half, and the recessed areas show poor throwing. What is the likely fault?

H. K.

**Answer:** For stripping chromium and nickel from zinc base die-castings, the following formula works rapidly:

Sulfuric acid 5 pints, room temperature; glycerine 1 oz., reverse current, 6 volts; water 3 pints, lead cathode. The rate of stripping will be increased by adding water, but this also increases the tendency to pit. Copper sulphate, 4 oz./gal., may be added instead of glycerine to reduce pitting.

Control of pH and free cyanide in your bright copper may eliminate poor throwing power. Free cyanide content should be on the high side in order to prevent polarization of the anodes and help proper anode corrosion. In general, the higher the temperature in

the bright range, the higher the current density which may be used and accordingly, the better the throwing power in recesses. pH must be watched closely in a bright copper bath.

## Silver Anode Scum

**Question:** Please advise how to treat silver anodes which have become charged or polarized. Our silver solution is 3-4% silver. Recently cathodes refuse to accept deposits and the anodes become coated with a brownish-gray covering. I took a small amount of the solution, put it in a small glass tank, used the coated anode and used a reverse current and the deposit of silver on the cathode deposited rapidly at 2 volts, 1½ amps. What causes the anodes to take on this hard colored coating and refusing to carry current through the solution when cathode is placed in solution for plating, using the regular routine, but will plate when the current is reversed?

R. J. I.

**Answer:** Several factors may contribute to the formation of the blackish scum. If you are reasonably sure that the anodes themselves do not contain impurities, increasing free cyanide content may help. If the anodes do contain impurities, they should be bagged or filter cloths used on them. The controlling factors in corrosion of the anodes are mainly free cyanide content of the solution and anode current density. For most uniform results, keep the free cyanide on the high side and keep the anode current density low by holding the ratio of anode to cathode area not less than 1:1. Carbonate content should also

be closely watched as it affects the anode corrosion rate also.

## Water Stains

**Question:** Please advise the best cleaning cycle for copper and brass prior to the plating of gold and silver. I experience much difficulty with water marks and stains after cleaning—my work consists of refinishing worn jewelry. I also have trouble with staining and color change of deposited plate after baking lacquer.

In plating baby shoes, heated cleaning solutions cannot be used in cleaning the buffed surface before flashing for gold or silver finish and lacquering, due to loosening of the copper plate on the waxed surface. What can I use?

W. K. V.

**Answer:** The water marks and stains appearing on your work after cleaning are generally due to impure rinse waters, or if your rinse water is fresh running, it in itself may be extremely hard, having high, iron, etc., content. For cleaning the buffed surface of the baby shoes after copper plating, would suggest you use cold carbon tetrachloride, trichlorethylene, or any of the chlorinated hydrocarbons. If you have a degreaser, the cold solvent should remove the buffing compound—try not to leave too much of the compound on the work from the buffing wheel.

## Cadmium Chloride Solution

**Question:** I intend using cadmium chloride instead of cadmium oxide in plating small pieces. Can you tell me of any precautions I should use or whether or not this substitution will work.

L. G. S.

**Answer:** It is possible to plate cadmium from acid chloride or sulphate solutions, using hydrochloric or sulfuric acid, but the deposits are coarsely crystalline and entirely unsuited for

commercial practice. It is suggested that you try to exchange the chloride for the oxide and plate from an alkaline cyanide solution.

#### Acid Waste Disposal

**Question:** Would you furnish us with the safest and easiest way to neutralize a strip solution if the operator should get nitric acid instead of sulphuric acid in a sulfuric, glycerine strip solution.

D. P. F.

**Answer:** In proper proportions, sulfuric, nitric and glycerine will form nitro-glycerine, which is of course highly explosive. However, such picking solutions are quite dilute and the hazard, while still great, is less than in the pure state. If this happens, solution should be diluted completely and neutralized with lime.

#### Plating Racks

**Question:** We wish to clean, pickle, bright nickel plate and chrome plate some steel stampings on the same rack. Can you advise the best procedure to do this without contaminating our cleaning cycle and plating solution?

H. G. S.

**Answer:** This is being done in the industry. Racks are generally masked off with material that is impervious to both the cleaners and pickle, as well as the acid nickel and chrome solutions. This masking material can be secured from any reliable plating supply house. It is of course extremely important that the racks be thoroughly rinsed prior to immersion in any given tank to prevent contamination, especially of the chromium bath.

#### Rough Nickel Plating

**Question:** I plated a coffee pot with nickel-anode while the coffee pot was hanging from the rack, because I was trying to do away with sponging inside of pot with nickel solution after coming out of bright nickel. When I put the rack which holds the coffee pot and also an inside anode of Monel Metal in the bright nickel, the inside of the coffee pot is rough. I also tried nickel anode. What is the cause of roughness and what kind of anode should I use?

A. J. C.

**Answer:** Roughness in general in-

dicates impure solution due to organic or inorganic materials. Evidently, the nickel solution attacks the surface of the work before an initial coating is applied, due probably to insufficient anode area. If the anodes are clean, there should be no reason to suspect that they cause the roughness. Your trouble will in all probability be eliminated if you devise a means of pumping fresh, clean solution in and out of the pot during the entire plating cycle.

#### Corrosion Resistance of Nickel

**Question:** 1. Steel parts for service outside rust in a few days. Applications are:

Copper	.0004	— Buffed
Nickel	.0004	— "
Chrome	.00002	— "

2. Brass castings blister in chrome. All formulas are checked periodically and strictly maintained. Our cyanide copper and dull white nickel are used at room temperature.

A. F. W.

**Answer:** In connection with your first problem, the nickel plate is probably not heavy enough. Put on from .0007 to .0010. Remember that buffing reduces thickness.

Regarding the latter problem, we recommend reverse current for 15-30 seconds in the chromium bath by means of a double throw reversing switch.

#### Streaked Nickel Plate

**Question:** We plate buttons on racks and find that those on the lowest rack become streaked in the nickel plating. Can you give us the cause of same and any measures we can take to prevent such action?

L. L.

**Answer:** Because of the appearance of this fault on the lower parts in your solution, it is no doubt caused by impurities in the lower sections of the bath. This may be due to dirty anodes which accumulate dirt in the lower areas. It is suggested that the anodes be scrubbed clean and bagged.

Many times anodes are not long enough also. This should be corrected. It is also possible that you have zinc in the form of zinc sulfate in your solution. It is suggested that you clean the bottom of the tank, filter the solution continuously and maintain close chemical control.

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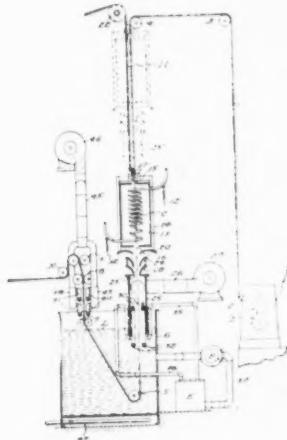
522 Park Place Long Beach, N. Y.  
Long Beach 1759

# Patents

## Brightening Tinned Strip

U. S. Pat. 2,420,377. Carl G. Jones, May 13, 1947.

The method of brightening tinned strip which comprises progressively moving the strip longitudinally in a predetermined path while progressively heating it until it attains at a point on said path a temperature of approximately  $437^{\circ}$  F., further heating it to a temperature higher than the melting



point of the tin coating but at a slower rate per unit of travel and, on attainment thereof, immediately cooling it in a gaseous medium to approximately the first mentioned temperature, and then quenching it in a liquid quenching medium to a temperature substantially below said first mentioned temperature.

## Rotating Sanding Device

U. S. Pat. 2,418,966. Teofil L. Banowski, April 15, 1947.

A rotatable sanding device comprising a drum consisting of a back plate adapted to be mounted upon a drive shaft, a removable front plate forming a cover for the drum and a uniformly perforated peripheral wall extending between the front and rear plates, a spindle positioned axially of the drum, a reel journaled for rotation on the spindle and slidably mounted thereon whereby said reel may be both rotated independently and slid axially of said drum, indexing means positioned concentrically with respect to the spindle and adapted to cooperate with complementary indexing means carried by

the reel to hold the reel from independent rotation on the spindle when the reel is slid axially to its locked position, the reel extending through an axial opening in the front plate, releasable clamping means exterior to the front plate and adapted to cooperate with the spindle for maintaining said indexing releasable means in engagement to thereby maintain said reel in locked position, a plurality of abrasive strips wound on the reel and extending through the perforations in the peripheral wall of said drum, and said clamping means being releasable to permit sliding movement of said reel and resulting disengagement of said cooperating indexing means whereby said reel may be slid axially of the drum from its locked position and then rotated to feed said abrasive strips outwardly of the drum.

## Sanding Block

U. S. Pat. 2,421,289. Louis Roth and John M. Schnaus, May 27, 1947

In apparatus for sanding edge faces or the like comprising a table, a sanding block, main spring means operatively mounted in relation to said table for entirely suspending said block, said block having a face conforming to the edge face to be finished; a sanding belt operatively associated with said block; means for driving said belt, the belt being trained over the face of said block, means for adjusting said spring and a pair of auxiliary springs attached to said main spring and said block for balancing the block and locating the face thereof.

## Treating Stainless Steel Electrolytically

U. S. Patent 2,422,903. Kenneth M. Huston, assignor to Western Electric Company, Inc., June 24, 1947.

The process for treating stainless steel articles, which comprises electrolyzing such an article as an anode at an anode current density of from about 350 to about 540 amperes per square foot in an electrolyte consisting of a water solution of fluosilicic acid of from about 10% to about 60% concentration for a period of from about twenty seconds to about two minutes while maintaining the electrolyte at a temperature not exceeding about  $85^{\circ}$  F., washing the thus-treated article with water, and making the

wet article the cathode in a cyanide brass plating bath of such composition as to deposit thereon a brass plate containing from about 70% to about 80% of copper.

## Selenium Rectifier Disc

U. S. Patent 2,422,192. Stanley S. Fry, assignor to Fansteel Metallurgical Corporation, June 17, 1947.

The method of producing blocking layer devices which comprises providing a supporting electrode with a layer of gray, crystalline selenium, subjecting the surface of the selenium layer to the action of vapors formed by heating potassium thiocyanate in the presence of air to its decomposition temperature and applying a counter-electrode over the treated selenium surface.

## Cleaning and Plating Copper

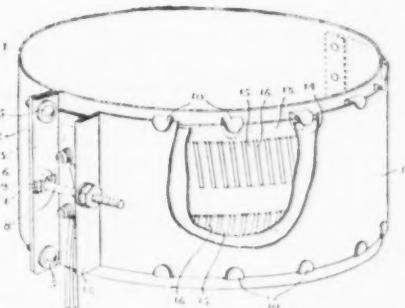
U. S. Patent 2,422,902. Kenneth M. Huston, assignor to Western Electric Company, Inc., June 24, 1947.

The process for treating conductors consisting principally of copper, which comprises making such a conductor an electrode in an electrolytic cell in which the electrolyte consists solely of an aqueous solution of fluosilicic acid containing at least 10% but not more than about 60% of said acid, and immediately introducing said conductor into a lead plating bath consisting essentially of a solution of lead fluosilicate and free fluosilicic acid.

## Electric Tank Water Heater

U. S. Patent 2,423,488. George P. Dowe, assignor to George P. Dowe Company, Ltd., July 8, 1947

An electric tank water heater com-



prising, a flexible metal band adapted to embrace a tank and having flanged ends, means adjustably connected to the flanged ends of said band to tighten

same about the surface of the tank, an adjustable flexible metal strip having one end rigidly connected to said band, a flat flexible removable electric heater element interposed beneath said flexible strip, and means for tightening the other end of said flexible strip to securely embrace said flexible heater element.

#### Belt Abrading Machine

*U. S. Patent 2,423,737. John B. Tavano, assignor to The Tavano Aero Engineering Company, July 8, 1947.*

In an abrading machine, a U-shaped casing open at one side and having a base, a motor attached to the rear of said casing and having a horizontal shaft, a pulley mounted on said motor shaft, a vertical rockable arm pivotally mounted at the top of said casing and having a handle for operating the same, a horizontal upper shaft secured to said rockable arm on an offset axis eccentric from the pivotal axis of said arm and located within said casing, a releasable pulley rigidly secured to said upper shaft, an abrasive belt passing around said pulleys, and a stop pin secured to said casing in the path of said arm at a point just behind the line passing through the axes of said motor shaft pulley and rockable arm, said upper pulley being releasable by forcing it forwardly past said line in a direction away from said stop pin.

#### Contact Rectifier

*U. S. Patent 2,423,091. William Fiore and Chester A. Kotterman, assignors to Federal Telephone and Radio Corporation, July 1, 1947.*

A rectifier comprising a stack of rectifier components including a plurality of flat electrode members having one surface uncoated and the other coated with a rectifying material, a contact member disposed between the respective electrode members for making contact with the rectifying material on one plate and the uncoated surface of the adjacent plate, said contact members being each provided with a yielding inner portion for making contact with the coated surface of one plate and an outer portion for making contact with the uncoated surface of the adjacent plate

and means for insulating said outer portion from the coated surface of the first mentioned plate.

#### Electrolytic Bright Polishing

*U. S. Patent 2,424,764. Harold I. White, assignor to The American Rolling Mill Company, July 29, 1947.*

A process of anodically polishing metals and alloys which under the influence of the electric current are not completely insoluble in phosphoric acid, which are low in metalloids, and which do not form bath-insoluble reaction products with phosphoric acid, said process comprising preparing an electrolyte consisting of from substantially 57.4% to substantially 82.9% by weight of the substance phosphoric acid, from substantially 10.1% to substantially 21.4% of water by weight, and from substantially 2.5% to substantially 32.5% by weight of an organic substance selected from the group consisting of normal butyl alcohol, secondary butyl alcohol, butyl acetate, normal amyl alcohol, secondary amyl alcohol, and amyl acetate, and electrolyzing therein such metals or alloys.

#### Manganese Dioxide Compound Plating

*U. S. Patent 2,424,958. Robert F. Clemens, assignor to The Dorr Company, August 5, 1947.*

The process of electrodepositing a manganese dioxide compound which comprises treating a leaching solution containing manganese sulfate and free sulfuric acid with a manganese bearing ore containing iron and having the manganese present as an acid soluble compound in such amount as to neutralize said acid to a degree such that the acidity of said solution corresponds to a pH value of not lower than 3 and not more than 4 to thereby cause the acid soluble manganese compound in the ore to go into the leaching solution as manganese sulfate, treating the thus leached ore pulp mass with a basic substance capable of forming a precipitate upon reaction with said acid in amount such as to reduce its acidity to a pH value of between 5 and 6, subjecting said mass to an oxidation to convert the ferrous sul-

fate to the ferric state thereby causing the ferric iron to be precipitated out of said solution, separating the leaching solution from said mass to obtain a purified leaching solution substantially devoid of iron, passing a direct current through electrodes immersed in an electrolyte bath of said leaching solution while maintaining said bath at a temperature of not less than 60° C. and not greater than substantially 70° C. and at a current density not less than 6 and not more than 9 amperes per square foot of anode surface to deposit on the anode the manganese in the form of manganese dioxide, and forming said leaching solution by diluting spent electrolyte withdrawn from said bath with water and adding sulphuric acid as required to obtain the said acidity of said solution.

#### Electrolytic Alloy Coatings

*U. S. Patent 2,424,173. Kenneth M. Huston and Vincent A. Rayburn, assignors to Western Electric Company.*

*July 15, 1947.*

The method of continuously electroplating a uniform brass coating upon a metallic strand, which comprises advancing such a strand as a cathode through an electrolytic cell employing an aqueous copper-zinc cyanide electrolyte of such composition as to plate a brass coating of predetermined composition upon the strand, making a mass of divided bodies composed of metal of the group consisting of brass, copper, and zinc the anode in the cell, the initial composite composition of the anode being such as to supply copper and zinc ions to the electrolyte in substantially the proportions in which these ions were present in the electrolyte initially, passing an electric current through the cell to continuously plate a brass coating upon successive increments of the moving strand, and maintaining the composition of the brass coating plated upon the strand substantially constant by adding divided bodies composed of metal of the group consisting of brass, copper, and zinc to the divided anode bodies as the plating progresses in such quantities and proportions as to maintain the concentrations of the copper and zinc ions in the electrolyte substantially constant and at substantially their initial values.

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ST

# Recent Developments

New Methods, Materials and Equipment  
for the Metal Finishing Industries

## Water-Shedding Liquid for Drying Metals

Enthon, Inc., 442 Elm St., New Haven, Conn., Dept. MF, have announced the development of a new product called "Hydrex," a water displacing liquid.

This product is a thin mobile liquid that is claimed to shed water from the surfaces of metals and to have very high penetrating power to enable it to displace water from blind holes and crevices. After the water has been displaced, the work is removed from the liquid and the solvent evaporates leaving a water-free surface with some rust-inhibiting properties.

The liquid is recommended for drying of plated work to prevent staining such as chromium plate, silver plate or cadmium. Spots that normally remain on the work from solids dissolved in the water, such as chromic acid or from the normal solids present in hard water, are said to be removed. The water separates to the bottom of the liquid and can be drawn off periodically.

The liquid is being used for drying of jewelry which contain many recesses which formerly required alcohol, distilled water, or saw dust drying. Silver plated work is being dried without spotting using Water Displacing Liquid followed by a vapor degreaser. This liquid can be used for drying of steel after pickling and is stated to be particularly valuable for drying in the presence of high humidity when rusting occurs. The liquid displaces the water from the surface of the steel and the thin film of material remaining acts as a rust-inhibitor without detracting from the appearance of the work.

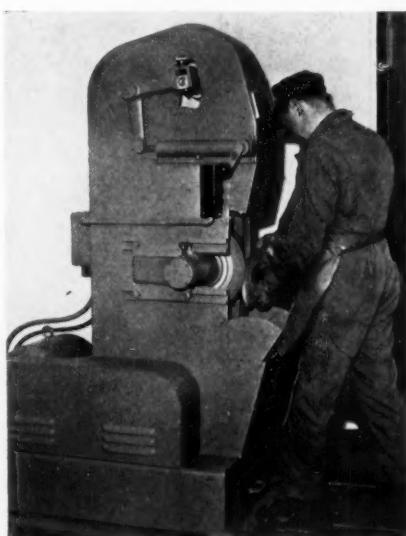
Full details regarding application and uses of the product are available from the manufacturer.

## Contour Belt Grinder-Polisher

The abrasive belt method of grinding-polishing has proved highly profit-

able and satisfactory. However, the grinding and polishing of contours, and maintaining a sharp, fully machined pattern, has been one obstacle to the complete application of this method.

In the Porter-Cable "C-6" a flexed abrasive belt approaches and leaves a formed contact roll at a slight angle. The abrasive belt "drapes" itself into



the pattern on the roll and grinds-polishes that pattern sharply with the speed, beauty and economy characteristic of the abrasive belt machining method, it is claimed.

The pattern is turned into the contact roll which is designed for the purpose and made of sisal and latex.

Grinding with flat-face contact rolls from the hard rolls to soft buffs is expedited by reason of the features of this new belt grinder, according to the manufacturer.

The unit requires a space of 26" x 38" and accommodates a 148" abrasive belt. Its contact roll is not a driving force, but an idler, thus heat, motor and shaft vibration which have caused considerable grinding difficulties in the past are avoided, it is claimed.

For further information, write Porter-Cable Machine Company, Dept. MF, Syracuse, N. Y.

## pH Block Comparator

A new plastic block comparator for pH control of plating baths and metal cleaning solutions has recently been made available by the LaMotte Chemical Products Company.

The plastic body is said to be more resistant to excessive moisture and corrosive fumes than its predecessor and is further claimed to withstand hard usage. In redesigning for the new plastic body, it has been possible to reduce its size; by tapering the observation slots toward the source of light, sharper color fields are said to result.

Produced with an eye to greater future use, the comparator is designed for interchangeability with many standard LaMotte procedures and is said to accommodate all the firm's color standards of regular size (15 mm.), new or old.

Descriptive literature and prices may be had by addressing The LaMotte Chemical Products Company, Dept. MF, Towson, Baltimore 4, Md.

## Metallic Sheathed Grinding Wheel

An ingenious metallic sheathed grinding wheel has just been announced by Chicago Wheel & Manufacturing Company and will be shown in operation for the first time at the National Machine Tool Builders' Show, Lodge Plant, Chicago, September 17 to 26. While the wheel itself is of the vitrified or ceramic bond, certain basic improvements have been incorporated into the bond which, when coupled with the metallic sheathing, are said to provide distinct advantages over conventional grinding wheels.

The metallic sheathing is said to be in no way detrimental to efficient grinding. There is a pronounced tendency to dissipate heat generated at the arc of contact over the entire area of the wheel by means of the heat traveling rapidly up the metallic sheathing and being rapidly dissipated. The metallic film in no way

affects the truing or dressing of the wheel, it is claimed, which is handled in the usual manner. The water-proofing qualities of the metallic film on the sides of the wheel keep the coolant at the arc of contact where it is needed for cooler cutting action and to avoid burning of the work. The makers claim the wheel cuts faster and cooler, with greater tool life between grinds.

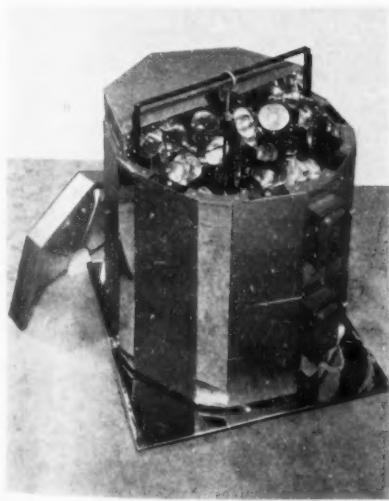
A number of different work classifications are stated to be advantageously handled with this new type of metal-sheathed wheel. Included are surface grinding, internal grinding and tool-and-cutter grinding. Substantial savings are claimed on many operations of this type.

The manufacturer calls this new type of metal sheathed grinding wheel the "Silver Streak." It is readily identified by its distinctive silver sheathing. For further information write Chicago Wheel & Manufacturing Company, Dept. MF, 1101 W. Monroe St., Chicago 11, Ill.

#### Plating Rack Drying Tub

Recent developments for rack coatings have resulted in new drying equipment for coated racks. The drying equipment is known as the Rack-Tub and is manufactured by The Miskella Infra-Red Company; its use is designed for preheating and final baking operations in rack insulation treatments.

The Rack-Tub is portable and comes ready to plug into a single-phase 230-volt line, although three-phase wiring can be furnished, with a total load of 8KW or 35 amperes. The unit is made with two heat zones



and sixteen toggle switches for control of the 32 fixed-focus 250-watt lamps furnished with the equipment for processing shorter racks and odd-shaped racks.

Floor space required is one square yard; height, 48" overall; weight, 200 pounds. The top is removable in two halves and the cross-bar support for holding the racks is adjustable for rack lengths under 42" and 20" across. The oven interior is insulated throughout.

Other uses for this equipment are said to be short time drying of set-up grinding and polishing wheels as well as the baking-out of dipped or sprayed lacquers or synthetic enamels.

#### Right! IT'S "GOOD-BYE FOREVER" TO OBJECTIONABLE ODORS OF OLD-FASHIONED ADHESIVES!

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Among America's leading industries . . . and in foreign countries over the globe . . . GRIPMASTER leads the way to new profits from polishing. Do this now. AT OUR EXPENSE, discover for yourself how GRIPMASTER (with its secret high-heat resisting ingredient) can increase your production . . . give you far more pieces per head! Clip coupon below. Send for generous free sample today!

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For further information, write The Miskella Infra-Red Company, Dept. MF, East 73rd and Grand Ave., Cleveland 4, Ohio.

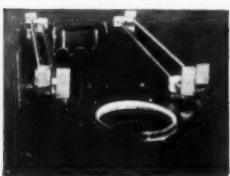
#### Cast-Steel Thermostatic Traps

Sarco Company, Inc., Dept. MF, 475 Fifth Avenue, New York 17, N. Y. is now making cast-steel thermostatic steam traps with the patented Sarco helical bellows to satisfy the field demands for traps which are claimed to withstand the shock of external explosions, such as occur in oil refineries and chemical plants; handle corrosive condensate; and operate with pressures to 300 psi or with superheat.

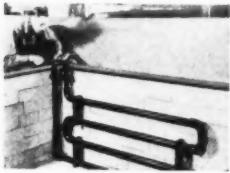
The cast-steel body and cap are

# HEIL

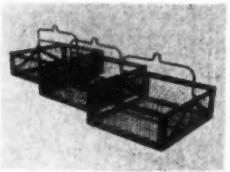
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**CHEMICAL PROOF  
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Tank assembly consisting of steel shell, lead lining, brick sheathing, fume duct and bus bar.



Necordal carbon coils and heat exchangers solve many of the problems of high temperature and severe corrosion.



Standard and special dipping baskets constructed to customer specifications.



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Lead Steel	Stainless Monel	Aluminum Alloys
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stated to provide the strength necessary to withstand the shocks of external explosion which shatter other types of construction.

The stainless steel thermostatic element safely handles corrosive condensate and permits these traps to be used for superheat or for a maximum operating pressure to 300 psi, according to the manufacturer. Another of this series has a bronze thermostatic element for maximum operating pressures to 225 psi saturated steam.

The thermostatic element is a patented helical bellows which permits a much larger orifice than can be provided on float or bucket traps. The

greater air venting capacity provides rapid heating from a cold start.

No seats to change for pressure changes or fluctuations are required because the differential between the pressure created in the thermostatic bellows and the steam pressure remains practically constant.

When installed to discharge to the atmosphere, no protection is required against freezing.

### Synthetic Protective Aprons and Sleeves

A new line of protective apparel for protection against acids, caustics, oils and solvents is now being made by

the Industrial Products Company.

Made of a new multi-purpose clear plastic material that is light, flexible and comfortable wearing, the apparel is claimed to be extremely tough thus resisting snagging, abrasion and wear. No stitching is used in the manufacture, all seams being made by electronic sealing. The aprons are fitted



with reinforced grommets and furnished with tubular laces of the same material. The sleeves are 14" long and are fitted with adjustable elastic bands at both ends.

To obtain more details write to Industrial Products Company, Dept. MF, 2820 N. Fourth St., Philadelphia 33, Pa.

### Plating With Alkanesulfonic Acid

The application of alkanesulfonic acids to the metal finishing field appears to offer possibilities. Alkanesulfonic acids have the general formula  $R - SO_3H$  where R may be a methyl, ethyl, propyl, etc. group.

Extensive exploratory electroplating studies have indicated that the alkanesulfonic acids offer substantial promise. Copper plating at current densities from 60-1000 asf from baths based on this new class of strong acids has been investigated. Semi-bright plate is deposited without the need of addition agents and it, as well as matte plate, is said to be easily color buffed on wheels or electrolytically. Bright nickel, deposited directly on the semi-bright copper, has good color. The metal salts are extremely water soluble. Alkanesulfonic acids are non-oxidizing, exhibit a higher solubility for or-

ganic substances than sulfuric acid and resist hydrolysis by water. These acids attack most common metals and their oxides.

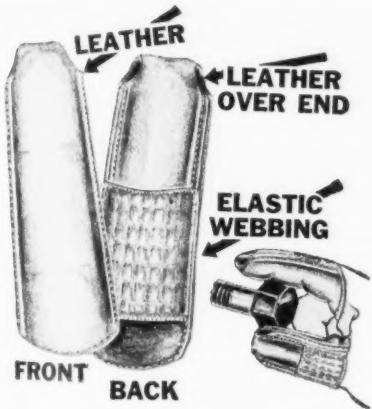
These unique properties indicate that a variety of other metal finishing operations, such as electropolishing, anodizing, etching, bright dipping, and the preparation of metal surfaces in soldering, bonding, welding, and coating, warrant further investigation.

Alkanesulfonic acid (mixed) is available from the Chemical Products Department, Section MF, Standard Oil Company (Indiana), in pilot plant quantities which should permit limited commercial application. Plans for commercial production are under way.

#### Polishing and Buffing Finger Guard

The "over-end" finger protection provided by the new finger guard recently developed by the Industrial Gloves Company, Dept. MF, Danville, Ill., is claimed to be remarkably effective.

In addition to protecting fingers and thumb on the face and sides, this new pattern extends the leather protection over the end of the finger, it is claimed. There is no seam or join at finger tip which means accurate, comfortable handling of even the smallest part for buffing, polishing, grinding, etc. The seams on the sides



are well up on top of the fingers and out of the wearing zone.

The special post-war designed elastic webbing on the back is said to assure comfortably tight, cool, non-slip protection at all times.

The new finger guard is made in three weights of leather: light, medium and heavy; in four sizes: small, medium and large for fingers and a size for the thumb.

# RACK COATING CUTS WASTE 50%



#### Unichrome Coating 202 Saves Costly Plating Solution!

When this plater sent his 202-coated racks through the plating cycle (which included nickel and rhodium) there was *less treeing, less dragout* — and rhodium consumption was actually cut in half! Why? Because the coating did not chip when contacts were cut — and there was no flaking or damage during hard use.

If you want the utmost in rack coating life — even in chromium or hot cyanides — consider what this service record means. It proves that Coating 202 is really *tough* — will take rough shop handling as well as the severe plating solutions it was designed for. Write your nearest Unichrome office for full details.



Trade Mark Reg. U.S. Pat. Off.

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UNITED CHROMIUM, INCORPORATED • 51 E. 42nd St., New York 17, N.Y.  
Detroit 7, Mich. • Waterbury 90, Conn. • Chicago 4, Ill. • Dayton 2, Ohio • Los Angeles 11, Cal.

#### New Grinding and Polishing Machine

The Hill Acme Company has introduced a line of 2-Roll vertical abrasive belt grinding and polishing machines for flat polishing of ferrous and non-ferrous metals and other materials.

The machines are available in three general types: (1) strip type for processing strip material in coiled form; (2) plate or bar type which incorporates the use of feed or pinch rolls for conveying the material under the polishing head; (3) sheet type with reciprocating hydraulic table drive. Machines are built in a progression of widths up to maximum of 60".

Endless coated abrasive belts 10' 6" long are utilized on all "Hill" Grinding and Polishing units and this short



belt is said to have definite economical advantages over 20' 3" belts used on previous models.

The 2-Roll Vertical polishing head is the same for all three types of machines, and covers basically a dynamically balanced upper steel idler roll and a lower rubber covered contact or work roll, over which the abrasive belt travels. The rubber covered con-



## Winning number in burnishing!

It's the number of the new Wyandotte Burnishing Compound — that gives high luster to zinc, brass, copper, nickel, lead, silver and gold.

You can use Wyandotte Burnishing Compound 317 in either hot or cold water—and always get satisfactory results. This viscous liquid contains no soap or inorganic alkalies... so the hardness of water does not affect its burnishing action. And it does not form non-rinsable films that

may interfere with subsequent operations.

Try Burnishing Compound 317 for burnishing with steel balls... for burring... for combined burnishing and burring with chips or stones. You will find that it brings out a superior luster—whether you use it in open or closed barrels.

Your Wyandotte Representative will be glad to tell you more about the advantages of Wyandotte Burnishing Compound 317. Give him a call at any time.



**WYANDOTTE CHEMICALS CORPORATION**  
WYANDOTTE, MICHIGAN • SERVICE REPRESENTATIVES IN 88 CITIES

tact roll being the driving roll, it eliminates slippage of the abrasive belt thereby increasing belt life. A steel billy roll located directly below the contact roll is raised and lowered through the employment of air cylinders. A pneumatic belt centering device assures positive tracking of the belt, irrespective of dust, moisture or other disturbing conditions. This is the nucleus around which are built the appurtenances necessary to adapt each type of machine to a specific purpose.

Both the Plate and Strip Type Machines are designed or can be adapted for multi-stage processing, whereby a group or battery of machines can be placed in series for continuous polishing.

For additional information or recommendations, contact the Hill Acme Company, Dept. MF, 6428 Breakwater Ave., NW, Cleveland 2, Ohio.

### Treatment For Burns

Dr. Archie Edward Cruthirds of Phoenix, Arizona, reported that he had treated more than 500 burn cases with Hydrosulphosol, healing most of them without leaving scars.

Hydrosulphosol is said to be a fast-healing non-toxic product, containing a supersaturated solution of sulphur in a colloidal state, for the treatment of first, second and third degree burns and x-ray burns. It is stated to make non-scarring possible by aiding in the rapid growth of new healthy tissue, the basis of an important burn treatment principle—the faster the healing, the less scarring.

Applied to a burn, the solution is claimed to relieve pain almost instantly by forming an air-tight film over the burn area. This eliminates danger from infection by averting the concentration of bacteria. It is said to be a safe remedy for burns of all types, including those caused by lye, grease, open-flame or caustic acids.

For further details write to Rees-Davis Drugs, Inc., Dept. MF, 50 Charles St., Meriden, Conn.

### Variable Speed Polishing Lathe

A new 5 h.p. variable speed polishing lathe has been added to the line of machines manufactured by the Square Deal Machine Co., 8695 Otis St., South Gate, Calif. With differentials of speed for 1500 to 3000 r.p.m., the new machine is an intermittent unit run on sealed ball bearings and is not spring

loaded as are most variable speed units. This feature is said to increase the belt life and eliminate mechanical failures found in the spring loading type.

The lathe is driven with two 2" Rheeves belts and speed differential is maintained by turning the hand wheel conveniently located on top of the machine.

Square Deal also manufactures a variable speed dual polishing lathe with double spindle, double motor and double controls for continuous 2-man operation at variable speeds.

### **Stainless Steel Electropolishing Process**

An improved electropolishing process for stainless steel was demonstrated by The American Rolling Mill Company at the recent Industrial Finishing Exposition in Detroit. At the convention a miniature lead-lined electropolishing tank was used as a demonstrator. On cold-drawn stainless steel wire products, 2 to 8 minutes' time in the tank was necessary for a good polish. Rough surfaces, as in the case of castings and forgings, require slightly longer periods. The amount of metal removed is very small, usually only a half-thousandth to a thousandth of an inch.

The solutions used with these patented processes are: citric-sulphuric acid, glycolic-sulphuric acid, and phosphoric acid-butyl alcohol solution. In operation, the solution temperature is held between 185° and 200° F. Sludge precipitating in the polishing process is removed periodically. The phosphoric acid-butyl alcohol solution differs in that it operates at about 140°-160° and precipitates a slime.

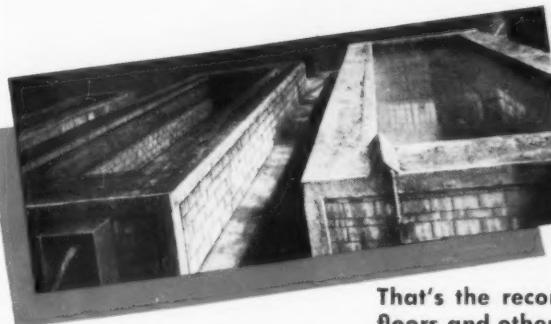
The current density for electropolishing is about the same as for electroplating. One-half to one ampere per square inch gives the best results in two solutions, but 1-1½ amperes should be used for phosphoric acid-butyl alcohol. A direct current source of 6 to 12 volts is sufficient to polish any parts.

According to the demonstrators, an important advantage of electropolishing lies in cutting polishing costs on certain products. They pointed out that in the case of small and intricately-formed products the cost of mechanical polishing is often prohibitive. But with electropolishing an extremely thin layer of metal is removed from the whole surface. This

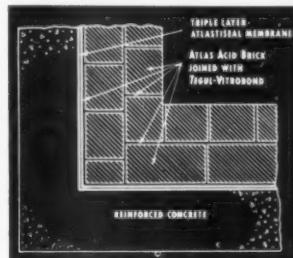
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These sulphuric acid pickling tanks are built of concrete, Atlas acid-proof brick and Tegul-VITROBOND and Atlastiseal (Atlas cement and Atlas triple membrane lining). This construction is proof against, not merely resistant to corrosives and does not deteriorate in years of continuous service.



**That's the record of Atlas pickling tanks, floors and other acid-contact equipment in plants of every size and capacity . . .**

Tanks and Floors of Atlas construction don't need vacations — don't take "down time" — entail no maintenance expense. They thrive on acids and alkalis, concentrated or dilute. High temperatures don't bother them and they're immune to corrosive salts, oils, steam and water. • Atlas units can be of any size from small tanks lined at our plant and shipped by truck or rail — to continuous pickling lines 200' and more in length. • Atlas materials include brick, tile, cements, linings and coatings, and Atlas corrosion-proof units include also ducts, towers, stacks, neutralizing and disposal pits. • We render a complete service including, if desired, construction by Atlas certified contractors. • Atlas engineers will be glad to study your individual corrosion problem, make recommendations and submit plans and estimates — without obligation. Contact our nearest branch. Write us at Mertztown for Bulletin TD-9.

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\*LOS ANGELES 12, Cal., 172 S. Central Ave.  
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SEATTLE 4, Wash., 1252 First Avenue, S.

DALLAS 5, Tex., 3921 Purdie St.  
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gives the entire product a brilliant lustre and solves the problem of polishing hard-to-reach crevices and recesses. When polishing small deep-drawn products, cathodes of special design may be used.

Sometimes the product may need mechanical work before electropolishing to remove grinding marks and deep scratches. Electropolishing exaggerates these imperfections; yet even on rough surfaces electropolishing is said to produce a bright finish.

This process is said to be excellent for polishing stainless steel wire products such as refrigerator shelves, meat

racks and kitchen tools. It removes light weld scale and discoloration such as that resulting from resistance welding.

An illustrated folder giving additional information may be obtained by writing The American Rolling Mill Company, Dept. MF, Middletown, Ohio.

### **Proprietary Bright Dip**

Copper-Brite, said to be a new safe solution for bright dipping of copper and copper alloys has just been introduced by the Rossau Company.

It is claimed to remove oxides, leave

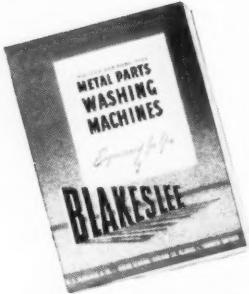


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To assure 100% grease free surfaces for subsequent finishes to automobile bodies, refrigerators, washing machines, toys and hundreds of other products, choose a Blakeslee Metal Parts Washer, especially adaptable to the cleaning of metal parts prior to surface treatment. Blakeslee sprays are designed to reach all surfaces and each machine is "tailor made" to do a specific cleaning job. From our experience in handling every metal piece from small watch parts to diesel engine crankcases, we have been able to build a washing machine designed to do a perfect job and to last for years.

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**BLACOSOLV**  
DEGREASERS AND SOLVENT

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METAL PARTS WASHERS

metal bright and shiny and resistant to future tarnish or discoloration. Metal is left passivated and ready for the next operation, it is stated.

The traditional platers' bright dip, sulfuric and nitric, as users know from unpleasant experience, creates offensive fumes and is highly toxic. The outstanding advantage of Copper-Brite is claimed to be that it is non-toxic non-fuming and safe for the worker to handle.

Manufacturers of gold plated jewelry, locks, bronze doors, brass fittings

and similar goods will welcome this simpler, safer solution. Used at room temperature in acid resistant still tanks, the solution requires a dip and clear water rinse. Five seconds of immersion are claimed to be required for a bright dip; three minutes for removal of heat scale. It is definitely claimed that the dip will not discolor silver solder.

For additional information, please contact the manufacturer, Rossau Company, Dept. MF, 119 W. 63rd St., New York 23, N.Y.

### Skin Protection for Bright Metal Surfaces

Recently developed by Dennis Chemical Company, is a new, protective, liquid-plastic coating for polished or bright metal called "Redskin." The coating is applied by spray, brush or dipping on bright metal surfaces and is said to dry quickly forming a tough, elastic film that is impervious to rust, chemical reaction, smears, or normal handling.

When desiring to uncover bright surface, the edge is picked up with finger nail and coating peeled off the entire surface in one continuous strip. Parts protected with this new coating may be completely fabricated before removing protective "skin." Assembled items may be coated for storage or for protection in shipping. It is not affected by atmosphere or climatic changes.

Full information and sample upon request to Dennis Chemical Company, Dept. MF, 2700 Papin St., St. Louis, Mo.

### Eye Washing Fountain

A new eye washing fountain for the immediate flushing of eyes that have been exposed to irritating vapors, liquids, dusts, chemicals, or smoke has been invented, designed, and developed by Benson & Associates, Inc., 332 South Michigan Ave, Chicago 4, Ill., and is now manufactured by Precision Scientific Company of Chicago, Ill.

Eye injuries are a possibility whenever and wherever any foreign matter contacts the eye. Many eye injuries result every day from contacts with harmful and irritating materials prevalent throughout all industry. When these substances enter the eyes serious injury, great pain, and even blindness may result, especially if immediate means of water washing is not available. Eye specialists have for many years recommended the use of copious amounts of water for flushing the entire eye area when these injuries occur.

The new eye washer is essentially a double fountain with standard inlet and drainage connections. The openings are so arranged that two streams of water are simultaneously directed against the eyes. Water pressure can be regulated so that a soft stream is produced assuring a copious but easy flow. The cast aluminum bowl is de-

Dennis  
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signed to fit the upper contours of the face. The actuating valve is operated merely by resting the head on the upper portion of the bowl; this type of operation makes it necessary to keep the eyes in the ideal range of the streams of water. In addition it allows freedom of the hands to spread the eyelids apart assuring contact of the water with every portion of the eye tissues which have been contacted by foreign substances. A pressure regulator is built into the actuating valve. The entire unit is readily installed in any laboratory, plant, or first aid room.

### Alloy Sprayer

The new Forrester Alloy Sprayer has just been announced by K. & F. Metal Spray Industries, 11204 Charlevoix Avenue, Dept. EE-MF, Detroit 14, Mich. This sprayer is an all electric unit, using AC or DC current. The air requirements are 3½ cubic feet per minute at 30 to 40 lbs. pressure. Temperature control is adjustable from 100 to 600 F. and maintained within 1/10 of a degree. The entire unit is securely sealed within a brass shell designed to be free from dust, dirt and tampering. The nichrome wire of the heating units is imbedded in a special refractory material completely encased in a sheath of high temperature chrome steel.

Setting up operation only requires plugging in hose to the air pressure line, it is stated. The alloy to be used is dropped into the pot and the cover locked down, using almost any kind of low temperature metal. The gun beats quickly and the metal is said to melt in approximately 2 to 10 minutes. Spraying is accomplished by pressing the button on the handle.

Exceedingly fine reproductions are easily accomplished by inexperienced operators, it is claimed. So thin (approximately 0.00001" thickness) can be the coating that fingerprint lines, grains in wood, and the dot pattern in half-tone engravings are easily distinguishable through the metal even while it is being sprayed, according to the manufacturer. In a recent test run at one of the leading universities, a sample of tin roof, badly rusted, was sandblasted and then zinc sprayed with the sprayer to a thickness of .001" to .0015". After being exposed to artificial weather conditions for a period of over one year, the sprayed zinc deposit was said to be comparable to

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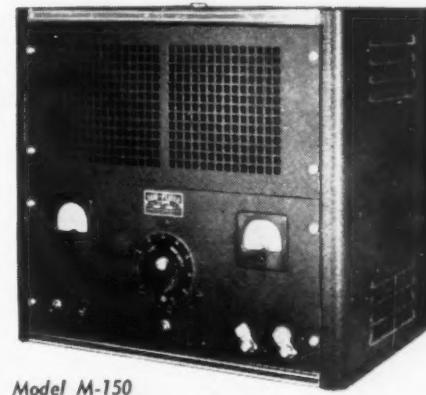
For laboratory and production work Lewis Electric offers a complete line of portable packaged industrial rectifiers ranging in output from 8 volts 25 amps to 8/16 volts 500/250 amps, and in size from 10½" x 21" x 15" deep to 42⅞" x 22" x 18" deep.

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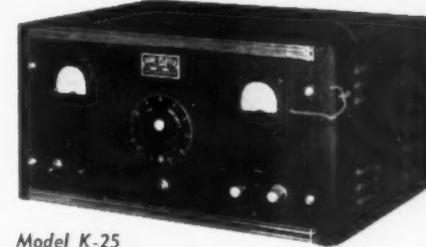
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• COPPER	• TIN
• CADMIUM	• ZINC
• BRASS	• ALLOYS
• BRONZE	• On Metals and Non-Metals.



Model M-150  
0-8 volts—150 amps  
Model MD-150  
0-8/16 volts—150/75 amps



Model K-25  
0-8 volts—25 amps  
Model K-50  
0-8 volts—50 amps

**LEWIS ELECTRICAL MANUFACTURING COMPANY**  
1266 GUN HILL ROAD, NEW YORK 67, N. Y.

the original 2-oz. zinc galvanize.

Size of work that can be sprayed is unlimited, while on large fixtures involving frames and braces, the operator can spray all surfaces rapidly, it is stated. Metal can be deposited to a thickness of 1/4" over a 4" by 6" area in less than 60 seconds.

This unique alloy sprayer can be used in producing: plastic molds, jigs, fixtures, tinning on carbon brushes, metal deposits on iron, selenium rectifier plates, metal veneer coating for wood, plaster, leather, etc., and pressed wood molds. Reproducing: models, molds, dies and masking for templates; and may be used to form protective coating for delicate hand tools, wood patterns, foundry molds, fixture metals, costly replacement parts for shipment, core boxes, plywood forming

molds, and plastic sheet molds.

Available in three standard sizes: Model H-5 with a 6 cubic inch pot capacity, Model H-7 with a 12 cubic inch pot capacity and Model H-8 with a 24 cubic inch pot capacity, these three models are manufactured in horizontal or vertical types, depending on individual requirements. Special alloy sprayers designed for higher temperature ranges and larger pot capacities are available.

#### Plating Rack and Tank Coatings

A series of applied coatings and linings for plating racks, drums and tanks, dip baskets, acid buckets, etc., is being marketed under the trade name Paraline by The Barber-Webb Company.

No. 1 and No. 9 of the series are



# SPECIALIZED FINISHING

## PUBLICATIONS

2 MONTHLIES . 2 GUIDEBOOK DIRECTORIES



GUIDEBOOK  
DIRECTORY

The "bible" of the electroplating and allied industries. 17th annual edition to be published in June 1948. Pocket size and completely sectionalized. 1947 sales message of 144 suppliers.



### METAL FINISHING

The engineering publication of the electroplating and allied industries since 1903. Its authoritative editorial content covers the metallic surface treatment market at home and abroad. 7 x 10 type page. All paid circulation at \$3 per year.

### ORGANIC FINISHING

The industrial product coating magazine originally part of METAL FINISHING. Covers the lacquering, enameling and painting of metal, wood and plastic products with selected paid and controlled circulation. Pocket size.

### ORGANIC FINISHING GUIDEBOOK DIRECTORY

Published as the April 1948 issue of ORGANIC FINISHING with regular advertising rates prevailing. Contains exclusive valuable Conference material plus product and trade name Directory.



CCA



## METAL INDUSTRY PUBLISHING CO.

Established 1903

11 WEST 42ND STREET

NEW YORK 18, N. Y.

TRADE  
MARK  
ABBOTT  
BRIGHT SPOT  
IN PRODUCTION  
PLANNING

THE ABBOTT BALL COMPANY, HARTFORD 10, CONN.

said to offer protection against all acids while the No. 1 is claimed to have withstood lengthy tests under various operating conditions, including solutions of hydrofluoric and nitric acids and sulphuric acid copper plating solution. It is also claimed that this coating is being used successfully as a lining for chromium plating tanks. No. 24 of the series is stated to be widely used as an acid resisting material for coating the outside of tanks.

Further information may be had by writing The Barber-Webb Company, Dept. MF, 3868 Rheem Ave., South Gate, Calif.

## Business Items

### Electric Equipment Company Establishes New York Office

The establishment of a New York sales office at 224 E. 38th St., New York City, is announced by President Irving S. Norry of the Electric Equipment Company of Rochester, N. Y.

The company carries a complete line of both new and rebuilt electric motors, generators and transformers for the plating industry.

### Cambridge Wire Cloth Appoints California Sales Engineer

The Cambridge Wire Cloth Company, Cambridge, Md., announces the recent appointment of Mr. Leslie F. Moody, 1563 Trestle Glen Road, Oakland 10, Calif., as sales engineer to cover the state of California.

The firm is a manufacturer of wire baskets and other wire products for use in the metal finishing field.

### Vandevander Forms Plating Partnership

Announcement is made of the formation of a partnership for the plating of non-conductors by W. K. Vandevander.

Formerly known as W. K. Vandevander, Precious Metal Plating, the firm is now known as KeepSake Metallizing Company, with Mr. Vandevander as president and Doris E. Buset as secretary-treasurer.

Equipment includes facilities for the

application of copper, brass, gold, silver and nickel on non-conductors. Production capacity at present includes facilities for plating 100 baby shoes daily. All plating baths are laboratory controlled.

#### Savage Joins Standard Plating Rack Co.

Frank K. Savage, past president of the American Electroplaters' Society, recently joined The Standard Plating Rack Company, 1925 N.



Frank K. Savage

Paulina St., Chicago, Ill., as assistant to the vice-president.

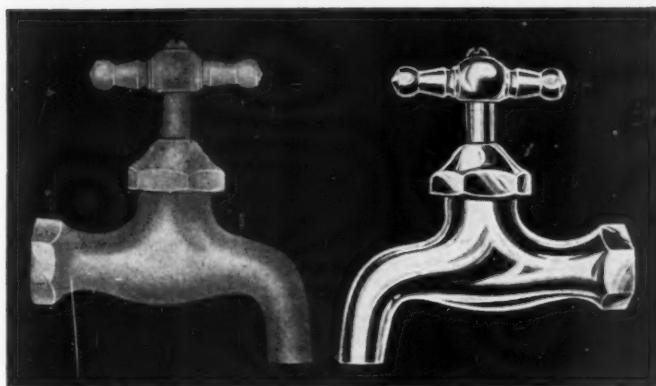
Mr. Savage, who was A.E.S. president for the year 1946-47, received his B. Sc. degree in chemical engineering from Michigan State College in 1935, and his Ch. E. professional degree in 1941. From 1935 to 1945, he was successively chemist, plating foreman, chief chemist and general superintendent with C. G. Conn, Ltd., Elkhart, Ind. From 1945 until his present appointment, Mr. Savage was electrochemical engineer for the Kuehne Mfg. Company, Mattoon, Ill.

Mr. Savage has been active in A. E. S. affairs for the past several years. In 1941-2 he was president of the Chicago Branch; in 1944 and 1945 he was a member of various Research Committees and vice-president of the society for two terms prior to becoming president.

#### McAleer Celebrates 25 Years of Service

Twenty-five years ago the McAleer

## BRILLIANT LUSTROUS DEPOSITS WITHOUT COLOR BUFFING ...AN IDEAL BASE FOR CHROMIUM



### NEW IMPROVED *Lustrebright* Bright Nickel Process

Produces Brilliant, Lustrous, Adherent Nickel Deposits • Eliminates Color Buffing — Re-Cleaning — Re-Racking • An Ideal Base for Chromium • Excellent Throwing Power • No Special Solutions or Changes in Equipment Required • Easy to Control • Low in Cost • Successful • Practical.

Gives uniform results and continuous operation on all classes of work in still tanks and mechanical barrels. Substantially reduces plating costs. Brilliant, lustrous, nickel deposits that may be chromium plated, are produced by merely adding NEW IMPROVED LUSTRE-BRIGHT to your present cold nickel solution, if of standard formula.

Work comes from plating tanks with bright, fine grained, adherent deposits. No color buffing or burnishing is required. Work may

be transferred direct from nickel to chromium bath, without intermediary buffing, re-cleaning, or re-racking. Excellent for zinc die-castings.

**GUARANTEED NOT TO HARM PLATING SOLUTION.** Will not cause plate to peel, become brittle, or produce streaky deposits. Illustration shows unbuffed deposits produced before and after addition of NEW IMPROVED LUSTRE-BRIGHT. Write for complete information.

**W. C. BRATE COMPANY**  
14 MARKET ST. Est. 1860

ALBANY, NEW YORK

Manufacturing Company originated the first of its rubbing compounds in a bathtub in Pittsburgh. Early in its history, McAleer moved to Detroit, seat of the automobile industry, where it manufactured a series of automobile cleaning and waxing compounds. At a later date it introduced its buffing compositions to serve the automobile manufacturers and allied lines of metal finishers. Then, requiring larger quarters, it moved to the present location at Rochester, Michigan, a suburban community strategically located in the center of Michigan's automotive and metal finishing industries.

During the war, this firm was one of the largest manufacturers of pyrotechnics, including bombs, flares and

mortar shells. It also turned out vast quantities of surface controls for L-5 T-18 reconnaissance planes, made aircraft gas tank seats and even produced axles for the Ford Jeep.

Due to the difficulty of obtaining essential materials to maintain controlled quality shortly after the war, many of McAleer's buffing compositions were temporarily withdrawn. Today these critical materials are again available and the firm is announcing the return and availability of its complete line of buffing compositions and finishing materials for both plastic and metal buffing and finishing.

The extensive research laboratory of the firm has been made available to all who have a particularly difficult

**FOR MIRROR FINISH** *Siefen*  
**BUFFING NU SPRAY GLU**

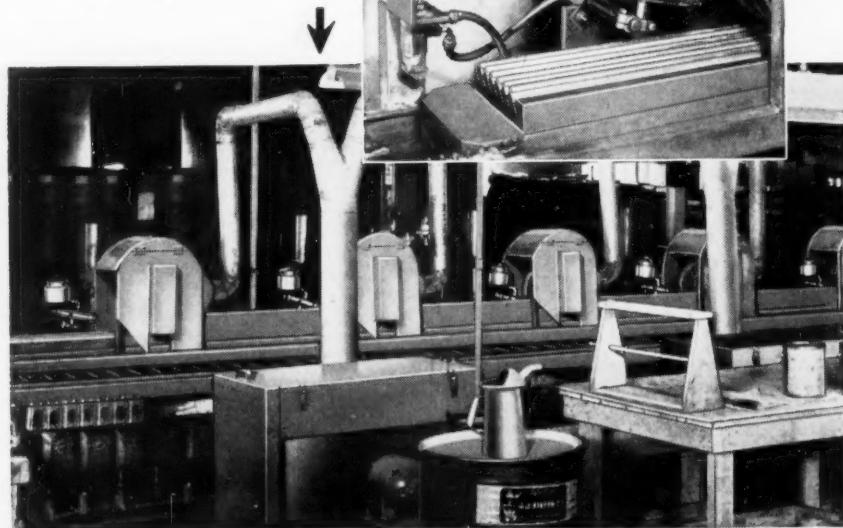
**B**UFFING Nu Spry Glu, a grease and abrasive mixture, sprays to wheel, cuts compound consumption in half and buff wear one third. Available in emulsion or oil-base types.

For satin finish—Nu Spry Glu. A liquid cold glue and abrasive mixture that dries instantly when sprayed on a revolving wheel.

**AND REMEMBER... NUGLU**

is a liquid cold glue for setting up polishing wheels.

Straight Line Automatic, buffing strip stock using Siefen Spray Method at Flint Moulding Products Co., Flint, Michigan.



**J. J. SIEFEN COMPANY**  
**5627 LAUDERDALE, DETROIT 9, MICH.**

problem of buffing, deburring, finishing or polishing and they welcome the opportunity to offer assistance in creating new formulas to serve those manufacturers confronted with the necessity for a tailor-made approach.

**Cunningham to Manage Devine Plant**

The H. K. Porter Company, Inc., has appointed Mr. John F. Cunningham, Jr., as manager of the J. P. Devine Manufacturing Company plant at Mount Vernon, Illinois, it was announced recently by Mr. C. R. Dobson, vice president in charge of operations.

Mr. Cunningham, formerly was research engineer and Manufacturing Division engineer for the Elliott Company, Jeannette, Pennsylvania, during the development of the first gas turbine power plant built in America. He has received degrees from Dartmouth College and Ohio State University in economics and mechanical engineering.

He is a member of the American Society of Mechanical Engineers, American Welding Society, Tau Beta Pi, and Sigma Xi.

**Taylor Becomes Wyandotte Research Supervisor**

Dr. A. Lloyd Taylor, formerly vice president in charge of Research and



Dr. A. Lloyd Taylor

Development for H. L. Shaw and Sons of Portsmouth, N. H., and Boston, Mass., has accepted a position as research supervisor in the Wyandotte Chemicals Corporation Research Laboratories where his experience will be

applied in the field of industrial detergents.

In addition to his work on detergents in his last position, Dr. Taylor has had many years experience in the same field as director of research for Oakite Products and as director of the Department of Chemistry for Pease Laboratories, New York.

#### Special Chemicals Promotes Bayer, Appoints Heiss

Special Chemicals Company, 30 Irving Place, New York 3, N. Y., an-



Walter R. Bayer

nounces the promotion of Mr. Walter R. Bayer to the position of sales manager. Mr. Bayer joined Special Chemicals as a sales representative in August, 1946. Previously, he was with the Electrochemicals Department of du Pont for a period of 21 years.

Announcement is also made by the firm that Mr. Ralph A. Heiss has been appointed a sales representative. Mr. Heiss was formerly in the Electroplating Division of Westinghouse Electric at Belleville, N. J. Later, he was plating and finishing foreman for Air Associates, Teeterboro, N. J.

#### Consulting Firm Organized

Dr. Leonard E. Ravich, electro-chemist and formerly chief chemist of the Royal Typewriter Company, Inc.; Harvey S. Levine, recently with PESCO Plating Equipment Corporation; and Dr. A. S. Cummins, specialist in the plating of non-metallies and formerly an instructor of analytical chemistry at Brooklyn Polytechnic Institute announce the formation of General Fin-



Before the game, they look alike—same uniform, same build, same action. But when the referee's whistle blows and the crowd roars—that's another story.

One proves to be the stand-out—a crack passer, punter, runner. That goes for coated abrasives, too!

Before you use them, they all look alike. But, when you put them to work, only one has all three—the longest lasting, fastest cutting and best finishing qualities that make it the stand-out!

And that's Michigan Coated Abrasives—the Abrasives with all three qualities, and in proper balance—balance that means performance that saves you money on materials and makes you money by producing more pieces with better finish at the least possible cost.

All we say is—try it and see. Phone, write us, or get Michigan Coated Abrasives the next time you order.

Michigan Abrasives are supplied in Sheets, Rolls, Discs, and Bolts—either paper or cloth backed—and in Silicon Carbide, Aluminum Oxide and Garnet—in full range of standard grit sizes.

Michigan's "Resin Bond" Fibre Discs—a sharp, quick cutting sheet metal abrasive disc—are highly recommended for general-purpose grinding and finishing of welds, clean up and many other operations.

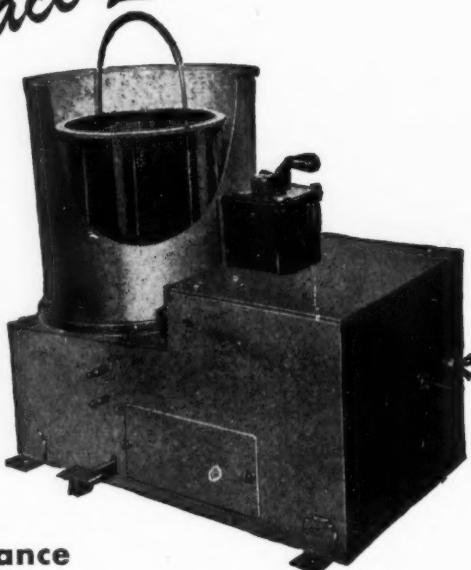


Michigan Abrasive Belts will do a better, quicker and more economical job than 90% of the work done on set-up wheels!

**MICHIGAN** *Coated Abrasives*

MICHIGAN ABRASIVE CO.  
1111 BELLEVUE AVE. • DETROIT 7, MICH.

*It all adds up to  
Better Surface Lustre*



## KREIDER

**Centrifugal Drying**

**=Uniform Drying**

**=Improved Surface**

**=Greater Rust Resistance**



Kreider Centrifugal Drying adds to the quality of small plated and lacquered parts. This speedy, economical method provides thorough, uniform drying. Finished parts have better film coating, improved lustre, greater rust resistance, longer life. And 35-second drying time plus one-man operation trims production cost.

The Kreider Dryer is compact, requiring minimum floor space. Equipped with  $\frac{3}{4}$  HP motor, V-belt drive, foot-brake and reversing drum switch. Steam or gas auxiliary heating units are optional.

Send for free bulletin giving complete specifications and showing Kreider Dryer installations.

**DELLINGER MANUFACTURING COMPANY**

727 N. Prince St. • Lancaster, Pa.



**FLEXO**

*Copper Wire*

Bare copper wire in coils or spools in all gauges for plating use. Prompt shipment. Catalog No. 60 on request.

**FLEXO WIRE CO.**  
OSWEGO, NEW YORK

*ishing Laboratories, Incorporated*, an organization dedicated to the service of the electroplater and the metal finishing industry.

Facilities consist of a fully equipped research and analytical laboratory supplemented by a pilot plant, which permits them to offer the following services: analysis of all plating and processing solutions; maintenance of finishing plants; complete consulting service; extensive research on all finishing problems; specification testing; plant layouts and installations.

Due to an unprecedented demand for a group of specialized products introduced to the industry several months ago, manufacturing facilities have been installed to make these compounds available in larger quantities. A partial listing of these products known as the GFL line includes bright nickel solution (still and barrel); rapid and bright copper plating baths; silver brightener; chromic acid stain remover; acid copper addition agent; chromium stripper.

### Mefford Chemical Company Incorporates

The Mefford Chemical Company of Los Angeles, Calif., having operated as a partnership since 1917, have incorporated as of May 1, 1947.

The dissolution of the partnership has been announced and the assuming of all obligations of the partnership by the corporation, which also takes possession of all assets, goodwill, equipment and stock of the partnership, made.

The ownership and management of the corporation remain the same as in the partnership.

### American Buff Company Holds National Convention

American Buff Company of Chicago, manufacturers of industrial buffs and polishing wheels, held their national convention in Chicago at the Shoreland Hotel recently.

Ben P. Sax, president, was guest to salesmen and representatives of the firm throughout the United States, representing offices in all principal cities.

Demonstrations were held throughout the new American Buff plant at 2414 S. LaSalle Street showing new methods of manufacturing. Other meetings were held on engineering,

sales methods, advertising, new products and the inauguration of the "Pot of Gold" sales contest, a new incentive plan.

#### Pinner To Attend London Conference

*W. L. Pinner*, past-president of the American Electroplaters' Society and manager of Research and Development of the Houdaille-Hershey Corporation, will attend the Third International Conference of the Electrodepositors' Technical Society to be held in London, September 17-20. Mr. Pinner will attend the conference on behalf of his Company.

#### Brown Names New Sales Engineers

The assignment of a new group of sales engineers to the branch and regional offices of the Brown Instrument Company has been announced by William H. Steinkamp, field sales manager for the Brown division of Minneapolis-Honeywell Regulator Company.

The new appointees are graduate engineers who have completed post-graduate courses at the Brown School of Instrumentation at Philadelphia. Those appointed and the cities to which each will be assigned:

*Edgar Andrews*, Atlanta; *Nilsson S. Bassett*, Boston; *R. J. Bierman* and *Clarence W. Swanson*, Minneapolis; *Edward J. Bryne*, Houston; *Warren H. Erfttenbeck*, Buffalo; *David J. Fair*, Dallas; *William R. Hamaker*, Detroit; *Charles F. Hintz*, Chicago; *Lawrence W. King*, New York; *Donald W. Larcen*, Milwaukee; *John F. Smith*, Tulsa, Okla., and *Andrew H. Albee*, Cleveland, Ohio.

The company, said Steinkamp, will soon name additions to its service engineering staff.

#### Gripmaster Contest Winners at Exposition

Prizes and winners of the *Win With Gripmaster* contest which was staged at the Industrial Finishing Exposition on June 23-27 were as follows:

1. Stewart-Warner radio; *Mrs. S. Poat*, 5588 Eastlawn, Detroit, Mich.
2. Shakespeare president reel; *H. W. Scofield, Jr.*, *May & Scofield Co.*, Howell, Mich.
3. Automatic electric toaster; *Ed-*

# CHROMIC ACID

**99.75% PURE**

With two complete, independent plants at Jersey City and Baltimore, and over a hundred years of technical background, Mutual is the world's foremost manufacturer of Chromic Acid.



**Bichromate of Soda  
Bichromate of Potash**

**MUTUAL CHEMICAL COMPANY  
OF AMERICA**  
**270 MADISON AVENUE** **NEW YORK 16, N.Y.**



FOR FASTER CUTTING  
INCREASED PRODUCTION . . .  
GREATER ECONOMY . . .  
**HARRISON 4A PRODUCTS**

Uniform, quality compounds for  
**BUFFING and POLISHING!**

• Our Stainless Steel Polishing Compounds are giving satisfaction to many of the country's leading companies. Quality is maintained at all times, so that you can order with confidence.

Write us at any time in regard to special problems. We will be glad to advise you and send samples of compounds that will meet your special needs.

**HARRISON & COMPANY, INC.**

**HAVERHILL, MASSACHUSETTS**

Double Header  
Compounds in  
Sizes — 150—  
180—220—240  
& 320



## You get all 3...

WITH SPEEDIE STAINLESS STEEL COMPOSITIONS . . .

### SPEED-EFFICIENCY-ECONOMY

Plants, large and small, whose operations call for buffing and polishing of stainless steel have found the use of Speedie Stainless Steel Compounds the surest way to save money!

Speedie Stainless Steel and Chrome Compositions are the answer to the need for rapid cutting and coloring of stainless steel and chrome of all types and descriptions, from cutlery to cabinets; from sinks to steering wheels!

Speedie Stainless Steel Composition 408 cuts down and colors in one operation. And yet it has never scratched—and never will.

Whatever your product or specialized polishing and buffing problem, one of Speedie's complete line of Buffing and Polishing Compositions—Tripoli, Nickel Finish, Satin Finish, Emery Cake, Grease Stick, Plastic—will answer your need. Write without obligation—today!

#### Polishing Room Supplies and Accessories



### THE BUCKEYE PRODUCTS CO.

7033 Vine Street Cincinnati 16, Ohio

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**PERMAG**  
Cleans the Surface  
for the Perfect Finish!



The surfaces of—Steel • Zinc • Aluminum • Brass • Copper • Bronze • Magnesium • Die-Cast Metals are CLEANED with PERMAG Compounds so thoroughly—so effectively—that a lustrous eye-appealing finish on the metal is a positive assurance. Ask any metal finisher who uses PERMAG.

If yours is a difficult and unusual finishing problem, our Technical Service will be glad to aid you. Write or 'phone.

### MAGNUSON PRODUCTS CORPORATION

Mrs. Specialized Cleaning Compounds for Industrial Purposes  
Main Office: 50 COURT ST. BROOKLYN 2, N. Y.  
In Canada: Canadian PERMAG Products, Ltd., Montreal-Toronto

mond Queenelle, 954 Felix, Windsor, Canada.

4. Remington foursome razor; *R. Westrop, Motor Products*, Walker Road, Windsor, Canada.
5. Parker "51" desk pen; *James Hedges, James Heddons & Sons*, Dowagiac, Mich.
6. Kitchen carving set; *Mrs. R. C. Lockerbie*, 317 Denver Ave., Goshen, Ind.
7. Cuff link set; *Lyle P. Reinwald*, 2764 Second Blvd., Detroit, Mich.
8. 1 dozen Wilson golf balls; *J. E. Gore, New England Buff Co.*, 493 C. St., Boston, Mass.
9. Ronson table lighter; *Joseph Lipchik, Glenvale Products*, 1165 Beaufait, Detroit, Mich.
10. 1 dozen Hagen golf balls; *William Streim, John Hassall, Inc.*, 400 Oakland St., Brooklyn, N. Y.

### Manufacturers' Literature

#### Abrasive Grains

A new folder explaining its *Carbolon* and *Exolon* abrasive grains has recently been released by *The Exolon Company*.

Several illustrations supplement the written matter explaining how the various abrasives of the company are made. The uses of abrasives manufactured by the firm are outlined and a table gives general recommendations for surface finishing in various industries, as well as for general metal polishing.

To obtain a copy of this informative folder, write *The Exolon Company*, Dept. MF, Tonawanda, N. Y.

#### Method for Polishing Stainless Steel

The *Du Pont Company* describes a new method for polishing stainless steel in an operating manual, *Du Pont Electropolishing Solution*, just published. The technique, which makes use of a solution of glycolic acid, sulfuric acid, and water provides the metal finisher with a new, economical method. It is not expected to entirely displace mechanical finishing.

The electropolishing solution, according to the manual, remains liquid at room temperature. It operates over

a wide range of current densities. Non-technical operators easily control and maintain the method at peak efficiency. Non-freezing characteristics of the solution eliminate temperature maintenance during periodic or week-end shut downs. Equipment used in electropolishing is substantially the same as for electroplating.

Write E. I. Du Pont de Nemours Company, Dept. MF, Wilmington, Del., for a copy of this booklet.

#### Recording Thermometers and Gauges

The Bristol Company, Dept. MF, Waterbury, Conn., has just published a 16-page bulletin, No. T835, on its recently announced line of series 500 recording thermometers and gauges. The new bulletin gives detailed information in the form of descriptions and pictures of the new instruments. Complete information covering chart ranges, chart drives, thermometer bulbs, and measuring elements is also given.

#### Corrosion Resistant Coating for Plating Room Equipment

An informational folder giving complete details on uses and application of Amercoat No. 33, a corrosion resisting coating for plating rooms and equipment, has been prepared by the Amercoat Division, American Pipe & Construction Company, Dept. MF, P.O. Box 3428, Terminal Annex, Los Angeles 54, California. A copy of the bulletin with full technical information is available upon inquiry.

#### Selenium Rectifier Facts

The Selectron Division of the Radio Receptor Company, Inc., 251 W. 19th St., New York 11, N. Y., announces a new 3 page bulletin on the subject of selenium rectifiers for direct current requirements. Included are illustrations of rectifiers covering a range of voltage and currents, together with their electrical characteristics, dimensions and weights.

#### Backstand Grinding and Polishing Methods

Step up Production, a recent illustrated publication intended for those engaged in finishing metal parts by grinding and polishing, is now avail-

# SHORT OF CADMIUM?

## TRY Luster-on<sup>\*</sup> on zinc

No question about it—cadmium is hard to get! But *Luster-on<sup>\*</sup> on zinc* may be your answer! **SAVE UP TO 60% OF CADMIUM COST!**

*Luster-on<sup>\*</sup>* produces attractive brilliance and passivity on zinc—giving a bright surface which resists stains, fingermarks and white corrosion. It gives to zinc plate an aging resistance, appearance and protection equal or superior to cadmium plate at a lower cost. *Luster-on<sup>\*</sup>* does not impair electrical conductivity or interfere with spot welding, and provides an adhesive base for lacquers and cements.

*Successful Luster-on<sup>\*</sup> applications include:*

Ventilation Equipment  
Fastening Devices  
Machine Parts  
Hand Tools  
Sporting Goods  
Refrigerator Shelves

Radio Parts  
Electrical Fittings  
Builders' Hardware  
Automotive Parts  
Nuts and Bolts  
Toys

**NOW AVAILABLE**—our new **SOLDERING FLUX** which makes strong soldered joints easy and practical on *Luster-on<sup>\*</sup>* treated zinc. Send coupon today!

THE CHEMICAL CORPORATION  
54 Waltham Ave., Springfield 9, Mass.  
Please send me:  
 Free information on *Luster-on<sup>\*</sup>*...  
 *Luster-on<sup>\*</sup>* vs. Cadmium cost data...  
 Soldering Flux information and sample...

Name \_\_\_\_\_

Address \_\_\_\_\_

Metal Finishing

September



## CHROMIUM NICKEL COPPER

Simple test sets for controlling these and other solutions available.

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CHICAGO 32

Specify Kocour Sets from your supplier.

# INVESTIGATE!

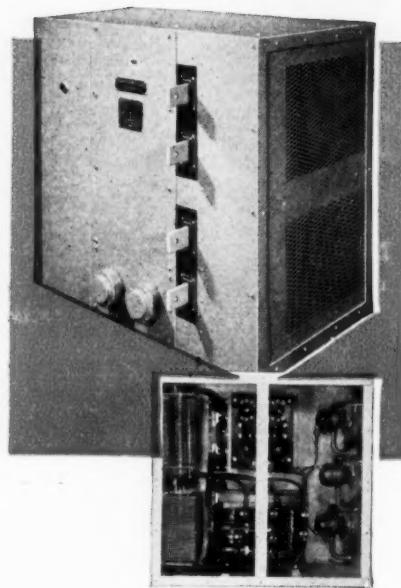
## BEFORE YOU INVEST IN DC POWER

**WAGNER-TIEDEMAN  
ELECTROPLATING RECTIFIER**

**Offers:**

- **FLEXIBILITY**
- **SIMPLE SERVICING**
- **LOW INSTALLATION COST**
- **LOW OPERATING COST**
- **LOW MAINTENANCE COST**

Selenium-on-aluminum cells handle momentary overloads up to 1000% of normal. Effective rectifying area over 4300 square inches. Three 40-watt fans provide ample low-velocity cooling. Transformer, two winding type, reserve capacity. Welded steel enclosure for vertical stacking if higher power is desired.



Output, 6 v. at 1500 amp., 12 v. at 750 amp., Input, 220/440 v., 60 cycle, 3 ph., power drain approximately 12 Kw. at full load. 34" high, 36" long, 22" wide, floor area 5.5 sq. ft. Weight, approximately 500 lbs. Other voltages and current capacities available.



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418 Midland Avenue

**Wagner**  
**BROTHERS INC.**

POLISHING AND  
PLATING MATERIALS

Detroit 3, Michigan

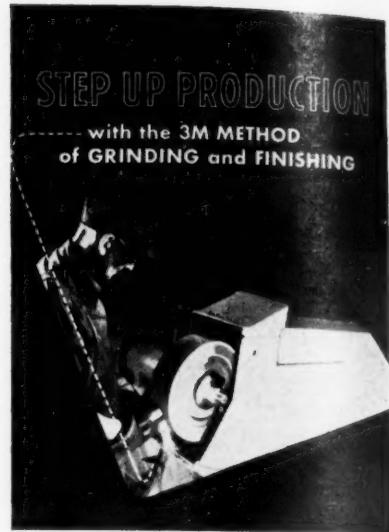
**A N A**  
**BRAND**

## Buffing and Polishing Compositions

### Cleaning Compounds

*Personal services to each customer a specialty*

**A. N. AUSTIN CO., Pequabuck, Conn.**



able on request from *Minnesota Mining & Manufacturing Company*, Dept. MF, St. Paul 6, Minn.

This 16-page booklet features the "3M Backstand Method" and contains among other data nine photographic case histories of plants which were able to cut grinding and finishing time all the way from 30% to 80% by adopting this method.

Also included are information and pictures of the various pieces of equipment which may be adapted to this method and a description of the 3M Methods Engineering Service which is available to those needing help on grinding problems.

### News from California

By Fred A. Herr

*James Poulsen*, formerly of the Milwaukee office of *Wyandotte Chemical Co.*, is now working out of the Los Angeles office in consequence of a recent shift in personnel. He has taken out membership in Los Angeles Branch, American Electroplaters Society.

*Reese B. Lloyd* has been appointed manager of western plants for the *Rheem Manufacturing Co.*, with headquarters in Los Angeles. He joined the Rheem organization in July, 1944, as production manager of the Chicago plant, and for the past year has been the firm's plant manager in that city.

Strip copper  
evenly,  
economically,  
non-dangerously.

USE

## McKeon's "Liquid Sulphur" TRADE MARK REG'D

No corrosive fumes.  
No etching of basis metal.

Trial quantity sent on approval.  
Service free.

Sulphur Products Co. Inc.  
Greensburg 7, Pa.

Quality Chemicals  
for over 50 years



COPPER SULPHATE  
NICKEL SULPHATE  
COPPER OXIDE

THE INVISIBLE TOOL...



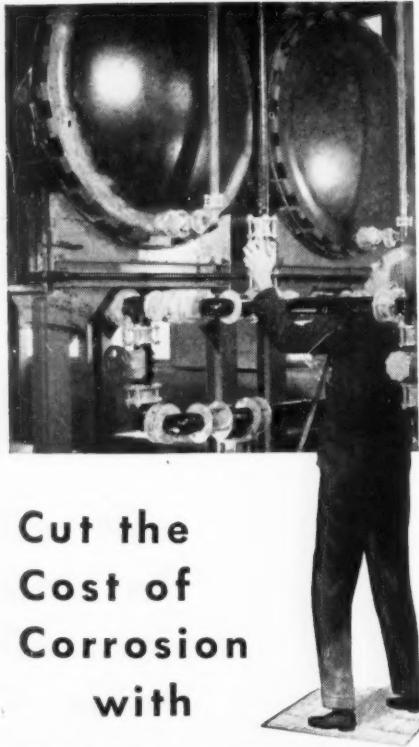
Removing fumes from soldering and brazing operations of The Lunkenhimer Company, famous valve manufacturers.

• Clean Air . . . You can't see it . . . but there's no denying its importance. Increased efficiency, greater production, fewer rejects . . . reduced absenteeism . . . all contribute to more profitable operation of any plant.

A Kirk & Blum System works wonders where a fume condition exists . . . clearing the contaminated, murky atmosphere and brightening not only your plant but your profit picture as well.

KIRK & BLUM Engineers will be glad to show you how a K & B System can improve your production . . . actually pay for itself over a period of time. The Kirk & Blum Mfg. Co., 2859 Spring Grove Ave., Cincinnati 25, Ohio.





**Cut the  
Cost of  
Corrosion  
with**

# HAVEG

**Process Equipment**

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for full data.*



Vacu-Blast Co., Inc., has completed a new factory and general office facility at 350 Peninsula Ave., San Mateo, Calif., and had hoped to be moved in from the former plant at Burlingame, Calif., by about the middle of August.

The firm manufactures the Vacu-Blaster, a new type blast cleaning device which cleans the surface with an abrasive and picks up the resultant refuse and abrasive by vacuum.

Articles of incorporation have been issued for Manco Plating Co., Inc., for operation in Los Angeles. Associated in the enterprise are Hugh H., Raymond E., and James R. Morrell, all of Los Angeles.

Deburring Metals Co., Inc., has been incorporated at Los Angeles, with capital stock of \$25,000, by P. R. and Charleston A. Kleinman, and Ray W. Burke.

Hooker-Detrex, Inc., jointly owned subsidiary of Hooker Electrochemical Co., Niagara Falls, N. Y., and the Detrex Corp., Detroit, now has a new plant at Tacoma, Wash., in full production of trichlorethylene, a chlorinated hydrocarbon solvent used in the metal finishing field for degreas-

ing metals.

The new plant is composed of three buildings, the entire production of which in August consisted of trichlorethylene.

Phillip Greathead, head of Square Deal Mfg. Co., South Gate, Calif., manufacturers of polishing lathes, was in the east on a business trip in August, visiting Detroit and other production centers in the mid-west.

## Associations and Societies

### AMERICAN ELECTROPLATERS' SOCIETY

#### Los Angeles Branch

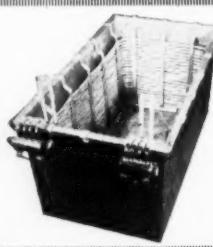
A note of tragedy enveloped the closing hours of the annual picnic of Los Angeles Branch, A.E.S., at Ladera Park, Los Angeles, on Sunday, August 10, when a low-flying airplane crashed into a tree within 200 yards of where members of the Branch were conducting a series of races for children.

The plane was piloted by a member of a group of Douglas Aircraft Co. employees who were holding a picnic near the A.E.S. group. The pilot, a 29-year-old woman and a 2-year-old child were killed and three other persons seriously injured. Stanley Rynko, Carroll McLaren and other members of the A.E.S. aided in removing injured from the wrecked plane.

Attendance at the A.E.S. picnic totaled some 200 members and guests. Highlight of the entertainment program was a baseball game between

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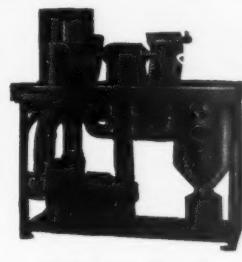
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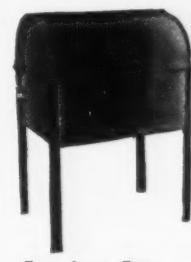
Polishing Bench



Dryer



Tubing



Sawdust Box



Sandblast

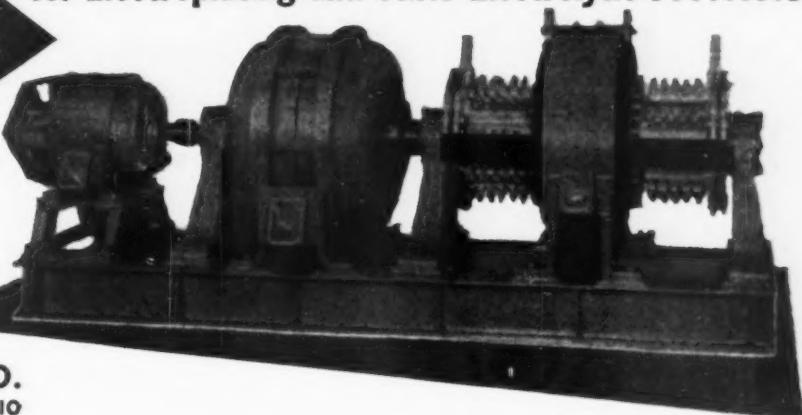
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the Platers and the Suppliers. The platers team took the measure of the Suppliers' team by an "estimated" score of 7 to 3, largely by virtue of some six or seven home runs made by the Suppliers which *Umpire Don Budwell*, himself a plater, "strategi-

cally overlooked" whenever the lead of the Plater's team appeared to be threatened.

### AMERICAN SOCIETY FOR METALS

The Publications Committee of the

*American Society for Metals* met in Cleveland on Friday, July 25th, to select the technical program of the Society for its 1947 annual meeting. The meeting was held as a part of the *National Metal Congress and Exposition* in Chicago from October 18th to 24th of this year.

According to *W. H. Eisenman*, ASM secretary, the Publications Committee is composed of sixteen prominent metallurgists whose professional interests cover the complete field of the science of metals. The Committee's personnel includes as chairman, *Walter Crafts*, Union Carbide and Carbon Research Laboratories; *Ray T. Bayless*, A.S.M., secretary; *Dr. R. H. Aborn*, U. S. Steel Corporation; *H. I. Dixon*, Sterling Alloys, Inc.; *Dr. A. L. Feild*, Rustless Iron and Steel Corporation; *Dr. J. H. Holloman*, General Electric Company; *R. P. Koehring*, Moraine Products Company; *Dr. H. B. Osborn, Jr.*, Ohio Crankshaft Co.; *Dr. F. N. Rhines*, Carnegie Institute of Technology; *Dr. E. S. Rowland*, Timken Roller Bearing Company; *Professor G. A. Sellers*, Kansas State College; *L. E.*



3

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Simon, Electro-Motive Corp.; Dr. Gordon Sproule, McGill University; Dr. R. L. Templin, Aluminum Company of America, and Dr. H. S. Van Fleet, American Can Company.

The function of the Publications Committee of ASM is to receive and survey all papers which are presented before any meeting of the Society. It supervises the publication of Transactions, an annual publication of the Society, and aids the 71 chapters of ASM in securing technical papers and addresses for presentation before local and national meetings.

#### ANNUAL SYMPOSIUM ON MODERN METAL PROTECTION

Third Annual Symposium on Modern Metal Protection, sponsored jointly by Cleveland sections of The American Chemical Society, The Electrochemical Society, and The American Institute of Chemical Engineers, will be held at the Hotel Carter in Cleveland September 27th. As in past years, two sessions will be held starting at 9:30 AM and 2:00 PM, with a group luncheon at 12:30. Authors have been asked to limit their papers in order to permit ample discussion periods.

##### Morning Session

Presiding—George W. Heise, National Carbon Co., national president of The Electrochemical Society.

1) "Some Notes on the Corrosion Behavior of High Nickel Alloys and Stainless Steels," H. O. Teeple, Corrosion Engineering Section, Development and Research Division, International Nickel Co.

Mr. Teeple will discuss the practical effects of temperature, concentration, aeration and other factors on the behavior of high nickel alloys and stainless steels with relation to the chemical and process industries. Slides will be used to illustrate the address.

2) "Selection of Protective Coatings for Metal Protection," K. G. Compton, finish and corrosion engineer, Bell Telephone Laboratories.

Mr. Compton will discuss test methods used with metallic inorganic and organic coatings as they relate to the type of service required of the coating. Tables will be presented showing the physical properties of various coatings and an outline of test procedures employed at the Bell

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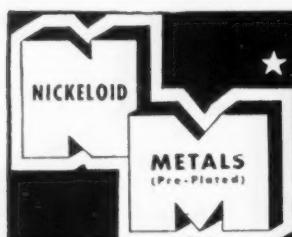
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3) "Corrosion Resistant Chemical Equipment of Stainless Steels," *H. L. Maxwell* and *W. R. Myers*, Industrial Research Division, E. I. DuPont de Nemours and Co.

Drs. Maxwell and Myers will discuss applications of the various grades of stainless steels and will present data bearing on continuity of operation and quality of products. The paper will summarize experiences where the use, and also the abuse, of stainless materials under process conditions have resulted in some interesting findings. Experiences showing profitable use in spite of higher initial cost will be reviewed.

4) "Corrosion Resistance of Hastelloys and Applications in Processing Equipment," *R. B. Long*, chemical and metallurgical engineer, Haynes Stellite Co.

Abstract not available.

### Afternoon Session

Presiding—*J. E. Hansen*, Ferro Enamel Corporation.

5) "Synthetic Rubber Derivatives as Corrosion Resistant Coatings," *J. B. Martin*, assistant product supervisor, Hercules Powder Co.

Following a short history of the development of chlorinated rubber based paints, Mr. Martin will discuss the theory of corrosion prevention by use of these materials. He will then use slides to show applications and use data for these paints.

6) "Organic Coating for Corrosion Protection," *E. R. Weidlein* and *George W. Seagren*, Mellon Institute of Industrial Research.

Abstract not available.

7) "Protective Coatings for High Temperature Applications," *W. N. Harrison*, chief, Enamelled Metals Section, National Bureau of Standards.

Committee representing the three societies includes: *J. W. Gartland*, chairman, *E. C. Gosnell*, *G. H. McIntyre*, *R. A. Schaefer* and *K. S. Williamson*.

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